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A New Shaper.

We illustrate by means of the accompanying engravings a shaper, in which, as will be seen, there is quite a radical departure from the usual construction in such machines.

It is thought by many mechanics that the modern shaper has been extended in stroke far beyond its limit of real usefulness, when it is considered that we have the planer for use on the larger and heavier work. One of the reasons for this is, that for the long strokes, a ram is required which extends for a considerable distance beyond its support at the rear, and for the shorter work, which usually constitutes the majority of the work done on the machine, receives no wear, so that, when the longest possible stroke is occasionally taken, it is not a straight-line motion, as it should be.

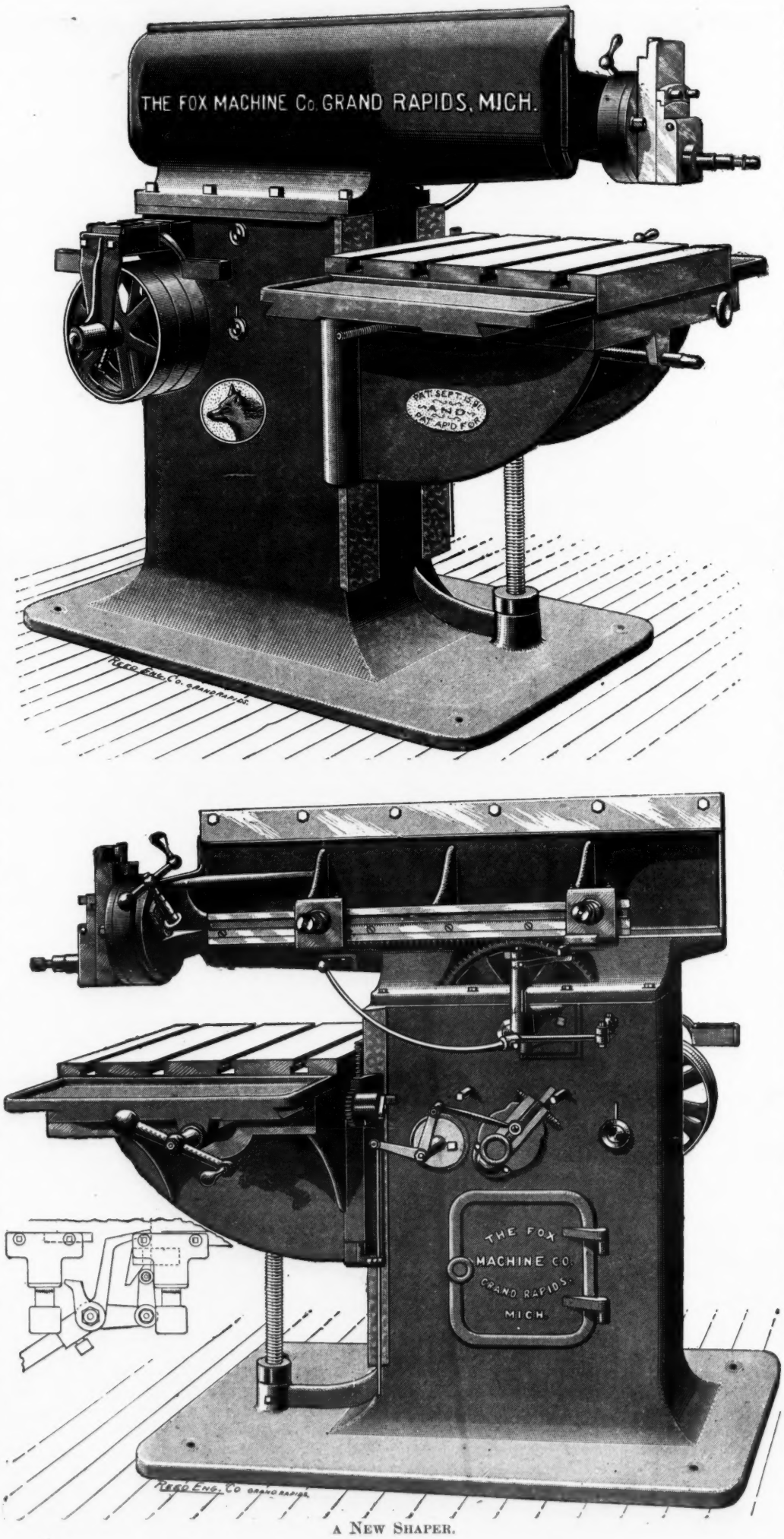
It is the object of the present design to overcome this difficulty by extending the support or slide for the ram out over the table, so that it is supported clear out to the end at any length of stroke, and, making the slide longer than the ram, provide for such a distribution of the wear on both, that the alignment shall be much better preserved. This necessitates putting the cutting head at one side of the slide, as shown by the front view, page 2, the rack being placed on a line between the slide and the head.

This construction has led also to a change in the arrangement of the screw and handle for the down feed, since it is evident that when the head is swung over toward the slide to plane down at an angle, the handle would be interfered with. It is consequently placed permanently at the left, and to the rear of the head, being connected to the nut of the down feed screw by means of the bevel gears seen, one of which is on a shaft which passes through the center upon which the head swivels.

The mechanism for reversing the motion of the ram is the same as that usually employed on planers, *i. e.*, there are two belts which are shifted, and the reverse motion may be of any proportion to the forward or cutting speed, depending on the proportions of pulleys put upon the countershaft. These are made to give a return of 3 to 1 or 4 to 1, as may be desired.

The screw which raises the table is placed just outside the center of gravity of the knee, and there is a vertical adjustment of 16″. The ram is 34″ long; the slide 44″; total length of table is 40″, with a bearing of 26″ on the knee; the planed surface on the table is 24″ square.

The feed is positive, and is released as soon as the feed has taken place. It can be made to feed at either end of the stroke, and in either direction. The length of stroke can be readily changed from 1½″ to 28″ by moving the dogs, and these dogs automatically fasten themselves in position without the necessity for tightening a screw. The machine weighs, complete, about 3,500 lbs. It is built by the Fox Machine Co., Grand Rapids, Mich.



A NEW SHAPER.

Standard Measurements in Machine Construction.*

BY FRED J. MILLER.

Different people have widely different ideas as to what constitutes an inch, a foot, or a yard. If you ask the average man what a yard is, he will say "it is three feet, to be sure." Ask him what a foot is, and he will say, "12 inches, of course." Ask him what an inch is, and he will either say "it is one-twelfth of a foot," or, acknowledging the truth, admit that he don't know.

Many a lady firmly believes that a yard of cloth is measured by the distance from the tip of her nose to the end of her outstretched fingers, and I have noticed that variations in the lengths of arms or of noses seem to have very little influence upon this belief.

The dapper dry goods clerk who presides at the dress goods counter always believes that he knows just what a yard is. And why shouldn't he? Isn't he measuring yards all day and every day? But his idea of a yard is that it is the distance between certain brass headed tacks driven into a counter, and, running the cloth between his fingers and thumbs, and placing the latter upon the brass tack heads, he is ready to affirm, with a confidence wholly sublime, that he has measured precisely a yard. He does not really know just what a yard is, and, of course, ninety-nine-hundredths of his customers are equally in the dark on this point. In one sense, it may be said that no one really knows what a yard is, for its length is arbitrary, and is not based upon any natural standard whatever.

In earlier times, when people first began to feel the necessity for having something in the way of standards of length, they adopted such natural standards as seemed most convenient or best adapted to their needs, and there was thus a time when "thirty-six barley corns, round and dry, placed end to end," made one foot, while at other times and places the arm of a king, or a human foot, became the standard of length—standards which, while they were good enough for the simple requirements of those days, would be utterly unsuited to the needs of our modern mechanics, many of whom work to one-quarter of a thousandth of an inch regularly, and think nothing of it, while,

*From a lecture delivered before the Young Men's Institute, New York City.

when occasion demands it, tool makers and others work within very much smaller limits than this, as I shall presently demonstrate to you.

It has been proven by comparisons of measurements made at different times, that, before the present precise and scientific methods of preserving and comparing standards were brought into use, there was usually a gradual change in the actual length of standards, the general tendency having been to lengthen. Such movements have, of course, been slow, requiring some thousands of years to lengthen the Egyptian cubit $\frac{1}{1\,7\,0}$ part of itself, while the English mile, in four centuries, lengthened about $\frac{1}{3\,0\,0}$ of itself.

It is, of course, evident that for the needs of our time there must be, somewhere, a standard of length which is, and which will probably continue to be, invariable; and which is so formed and arranged that different measurements of it, made at different times, or by different persons, will give the same results, or results so nearly alike as to be within the limit of variation allowable in the finest work executed by the most skillful mechanics of our day; a limit of variation which, as I shall show, is a very minute one.

If in any way an authorized or agreed upon standard of length should be lost or destroyed, it is readily seen that its exact restoration might be a matter of the greatest importance, and it is therefore natural, perhaps, that men should have devoted some attention to the determination of what have been called natural standards of length, which, it was presumed, would remain unchanged, and would always give the same values when comparisons were made with them. The barley corns, the king's arm, and the human foot were early natural standards which men soon learned would not answer, not only because the actual length of these would inevitably vary, but because, even supposing that no such variation took place, it would be morally certain that no two persons would agree upon the precise length of such standards within the limits required.

Other natural standards of a much higher degree of scientific and practical value have been made use of, among these being a pendulum, which, in a certain latitude at the sea level, in a vacuum would vibrate in a certain time, or swing from side to side a certain number of times within a certain period of time. This, to judge from what we know of pendulums, promised to be a very precise method of originating or restoring a standard of length, for we know that, under proper conditions, pendulum will swing at a rate bearing a fixed and invariable relation to their length, measured from their center of gravity to the point upon which they swing. But the main difficulty was found to be in determining precisely what this length was, and different measurements of it varied from each other so much as to show that the pendulum must be abandoned for that purpose.

The French government, in proposing to furnish to the world a universal standard of measurement, proposed to base this upon a natural standard, and with that object in view measured, by the methods of the astronomer, the length of that part of the meridian of the earth passing through Paris and extending from the equator to the pole. The ten-millionth part of this observed length was taken as the meter, and it was thought that, should all the standards of length in the world be lost or destroyed, they could be restored by again measuring this quadrant of the earth. This was established in 1799. It has since been demonstrated that there was an error in the measurement of about one in 4,000, or, in other words, that in a length of 4,000 inches there would be an error of 1", or, that in a length of one inch there would be an error of $\frac{1}{4\,0\,0\,0}$"—an error which is entirely inadmissible for present day requirements, because far greater than the limit of variation allowed by our best mechanics when doing their best work.

These and other failures to establish natural standards of length—none of which failures, however, so far as known, are to be attributed to this country, for the reason that no attempts have been made here in that direction—have led finally to the entire abandonment of natural standards, and to-day, in all civilized countries, the authorized standards of length are defined on metal bars, the ultimate basis of our standard being the British Standard Yard, the length of which can be defined only by saying that it is the distance between two parallel lines ruled on gold studs sunk in a bar of bronze, this length being taken when the bar is at a temperature of 62° F.

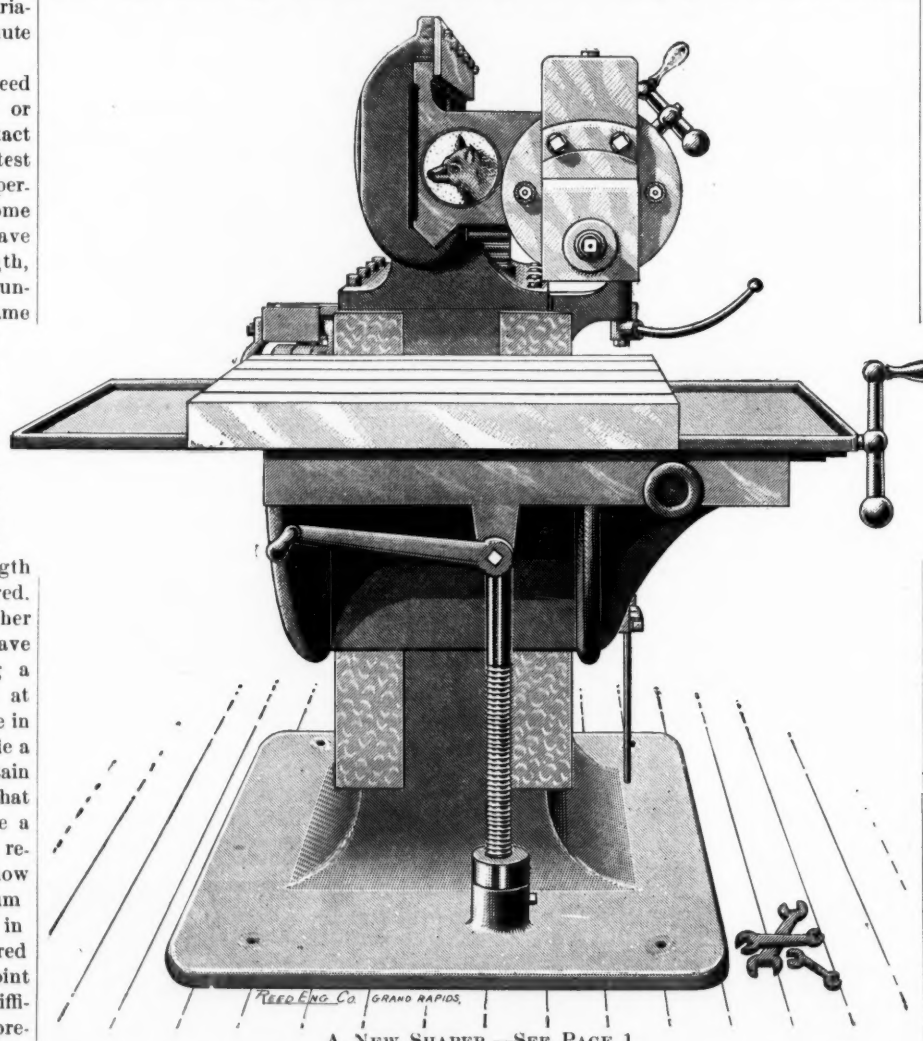
The bronze of which this bar is made is of the composition known as Baily's metal, which is 16 parts copper, 2½ parts tin, and 1 part zinc. The bar is 38" long, 1" deep, and 1 inch wide, the polished surfaces of the gold plugs upon which the lines are ruled being at a depth of one-half inch from the upper surface of the bar, in order that they may not be affected by the bending of the bar by its own weight. The lines are exceedingly fine ones, scarcely visible to the naked eye, and comparisons are made by means of microscopes having micrometer attachments by which very minute variations are readily determined and measured. The bar is, of course, very carefully kept in a place specially prepared for it in the Standards office, and is surrounded with every means known to science to protect it from injury or loss, and to enable exact comparisons to be made between it and other bars when necessary.

One of the traits which distinguishes man from other animals is his inclination to trade—an inclination which leads to an exchange of values, when, and only when, both parties to the trade receive benefit from it. This natural and proper desire to trade for mutual advantage recognizes no political boundaries, and has been in the past, as it is to-day, the chief means for the spread of civilization over the world. When men trade it is convenient, if not vitally important in many cases, that their standards of measurement and of weight shall agree, and thus the dissemination of standards of length has followed pretty closely the lines of trade. Seventeen, possibly more, nations derive their standard from the International Metric Bureau at Paris. Other countries take their standard from England, and from the bar just described, which is known as the Imperial Yard No. 1. From this bar a number of similar bars have been made and presented to various countries—one of these, known as "Bronze 11," having been presented to this country in 1856.

It is not found possible in practice to make copies so exact that variations from standard cannot be detected by the highly refined methods used, and instead of stating at the time the actual variation of Bronze 11, it was stated to be standard at 61.79° F. Subsequent investigations have shown that it is probably a fraction shorter than standard at 62° F., the probable variation being from 22 to 88 millionths of an inch. Admitting the greater variation, and supposing it to be uncorrected, our inch would vary from that of Great Britain by about .0,000,-025", an amount far too small to be of any importance, and really about eight times smaller than can be certainly measured by the best measuring machine or comparator used for the production of standard gauges for shop use.

It should be observed here that this principle of the employment of ruled lines on metal bars has been found in practice to be the best for reference standards, for the reason that, with proper facilities in the way of microscopes, etc., the position of lines on a bar can be determined with the greatest precision, and, above all, that the use of these lines does not in the least change the standard in any way, as would necessarily be the case with end measure pieces, which, every time they are used, are necessarily subjected to some wear, their length being thereby reduced. And it of course follows that even proper and legitimate use of such standards eventually results in their being so appreciably reduced in length as to make them entirely useless.

The question of temperature is an important one in making comparisons of length, since a very slight difference of temperature between two bars at the time of comparison would entirely vitiate the accuracy of the work, and it is difficult to prevent the heat radiated from the body of the observer from affecting a bar to some extent at least. For this reason it is important that standard bars should be made of the same metal or alloy, in order that they may have the same coefficient of expansion, or, in other words, be affected to the same extent by any change of temperature which may take place.



A NEW SHAPER.—SEE PAGE 1.

But the end measure pieces, graduated rules, plug and ring gauges, calipers, etc., used by machinists, are almost, if not quite universally made of steel, and it is therefore necessary that, at some stage in the proceedings, standards of steel should be compared with the bronze bars previously referred to. On account of the difficulty in overcoming the effects of changes in temperature, it is necessary, for commercial reasons, as well as important for mechanical reasons, that this comparison between bronze bars and steel bars should not be continually made, but that a steel reference bar should be provided, which, when once graduated, and carefully compared with the bronze standards, should thereafter be used in the production of standard tools of steel, so that in those comparisons, which are constantly being made, and which, for commercial reasons, must be made with comparative rapidity, the co efficient of expansion should be the same throughout.

For this reason I believe most measuring machines now in use for the production of standard gauges make use of steel bars, though the machine used by the Pratt & Whitney Co. at least is so arranged that any bar may readily be used, since it is only necessary to lay the bar to be used upon suitable supports provided for that purpose, so that its graduated surface comes within the focus of microscopes fitted with micrometer eye-pieces for reading the graduations.

A detailed and technical description of the method by which a tempered steel bar six inches in length was graduated by lines drawn by a diamond, and these lines compared with "Bronze 11," would require much more time than can be given to it this evening, and it is perhaps sufficient to say that it was done in this case by Professor William A. Rogers and Mr. George M. Bond, M. E., making use of every possible refinement, and that there can be no reasonable doubt that its graduations are so very close to those of the Imperial Yard No. 1 that the error, if there be any, is so small as to be of no practical importance whatever, being, in fact, probably not over 5-millionths of an inch at 62°.

The machine in which this bar is used is known as the Rogers-Bond Universal Comparator. One of the most commendable things in connection with this machine is that there is not the least attempt to throw any mystery about either its construction or operation.

It is fully described and illustrated in a book published by its owners, the Pratt & Whitney Co., and any visitor to their works who desires to see the machine can do so, and can see it operated, and, if qualified, even operate it himself, and thus all who are interested in the subject of standard or precise measurements have full opportunities for judging for themselves as to the probable degree of accuracy attained. The method of comparing the standard ruled bars used in connection with the machine is also fully described, and the results of observations given in detail in the same book, "Standards of Length and their Practical Application."

A detailed description of the machine is, of course, impracticable at this time, and I will content myself by saying simply that one of its features—that which the machinist would be apt to consider its most important one, perhaps, may be said to be a caliper, in which two hardened, ground and lapped surfaces of steel are brought together by the movement of a plunger, to which is attached a rod with a knob at the end; interposed between this rod and the plunger being a spiral spring, which, in making observations, is always compressed to nearly the same degree, in order to get uniform contact. Attached to the plunger is a plate, upon which is drawn a very fine line—a line which is, in fact, about $\frac{1}{8\,0\,0\,0\,0}$ of an inch in width. Two microscopes are mounted upon a sliding carriage, these microscopes being of sufficient power to magnify about 150 di-

ameters. They are both fitted with micrometer eye-pieces, by means of which the line to be observed by them is seen between what appear to be two other fine lines, one on either side; these lines being really pieces of spider's web which are attached to a slide moved through a short distance by a very fine screw, having micrometer graduations by which variations are read to about $\frac{1}{60000}$ of an inch.

In measuring, these contact surfaces are brought together, and the carriage is then moved until one microscope is over the initial line of the standard steel bar before referred to, while the other is over the line drawn upon the plate attached to the steel plunger. Now a piece to be measured being inserted between the contact points, and the carriage moved along until the second microscope is again centered over the line drawn upon the plate attached to the plunger, the other microscope will have moved over the standard bar a distance just equal to the diameter or length of the piece being measured, and this diameter or length is therefore indicated in terms of the steel bar divisions.

There are among my hearers some, no doubt, who are unfamiliar with such small magnitudes as those I am dealing with, and in order to render this talk more interesting to them, I should perhaps try to give them some idea of what $\frac{1}{60000}$ part of an inch means.

The expression "hair splitting" was formerly, and is now, sometimes used to designate people or mechanics who are supposed to be superfine, and who are not satisfied with working close enough, but must work finer, and, in fact, unnecessarily fine. But to-day, in the finer grades of work, working no closer than to a hair would not do at all, and as a matter of fact a hair must be split and re-split many times before it becomes fine enough to be commensurate with the degree of accuracy attained. Some persons are much more "fine-haired" than others, but the hairs from my own head, which are probably about the average in fineness, are something more than .002" diameter.

Now I have here a plug and a ring gauge made by the Brown & Sharpe Mfg. Co. They are of hardened steel ground and lapped very smooth and true, and, as you see, they fit each other very nicely; there is absolutely no play or looseness, yet when properly oiled and put together the plug slides freely through the ring, as you see. Yet the fit is really very close—so close, in fact, that upon being allowed to rest for a moment they stick together, as you now see them, so that I am unable to separate them, even by the exertion of my full strength, and what appears to be violence must be used in forcing the ring off the plug; *i. e.*, they must be hammered apart, and for that purpose I use this block of wood having a hole bored through it, and a rawhide faced hammer. This sticking is explained upon the supposition that when motion stops the ultimate particles of oil become flattened by the pressure, and thus no longer constitute what may be called a ball bearing, as they do while in a spherical state.

Now I have here another plug gauge which is just .001" smaller in diameter; upon inserting it in the ring, it is seen to be quite loose, and the "shake," as we call it, is quite perceptible. Most any machinist unaccustomed to micrometer measurements would say that it was pretty loose—$\frac{1}{64}$" anyhow, and it is at once seen that any good machinist can work with ordinary spring or hinged calipers closer than .001". Yet to go into the space between this plug and ring, an ordinary hair would literally have to be split, for the simple reason that its diameter is more than twice the size of the space between the plug and ring.

This snap gauge is just the size of the ring; any machinist would pronounce the job spoiled which was ground or turned as loose as that is; yet it is only .001". or half a hair loose.

But when we talk of $\frac{1}{60000}$ of an inch, then we mean a limit much below what is usual in machine work, and our hair would have to be split, not once, but 120 times, to equal it in fineness.

Yet no one who examines into the matter can doubt, I think, that such magnitudes are readily measured on the Rogers-Bond machine. A committee of the American Society of Mechanical Engineers, appointed to consider the subject of standards and gauges, after an examination of this machine made a report at a meeting of the society held in this city, in which, after

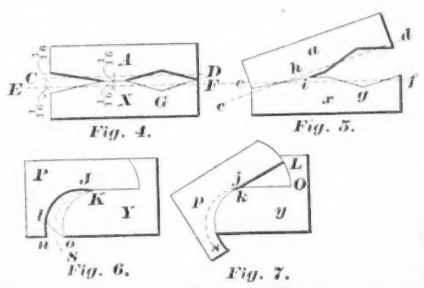


Fig. 4. Fig. 5. Fig. 6. Fig. 7.

POINTS OBTAINED FROM A MACHINE SHOP.

describing the machine and its operation, they said: "A test to determine the accuracy of setting to a single line on a ruled bar, made by six members of this committee—most of whom were quite inexperienced in the use of the microscope—showed between the highest and lowest of eighteen readings a difference of 5.5 divisions, a quantity less than $\frac{1}{100000}$ of an inch, while the average of the eighteen readings differed from the average readings of Mr. Bond by four-tenths of one division, or about $\frac{1}{150000}$ of an inch."

(*To be Continued.*)

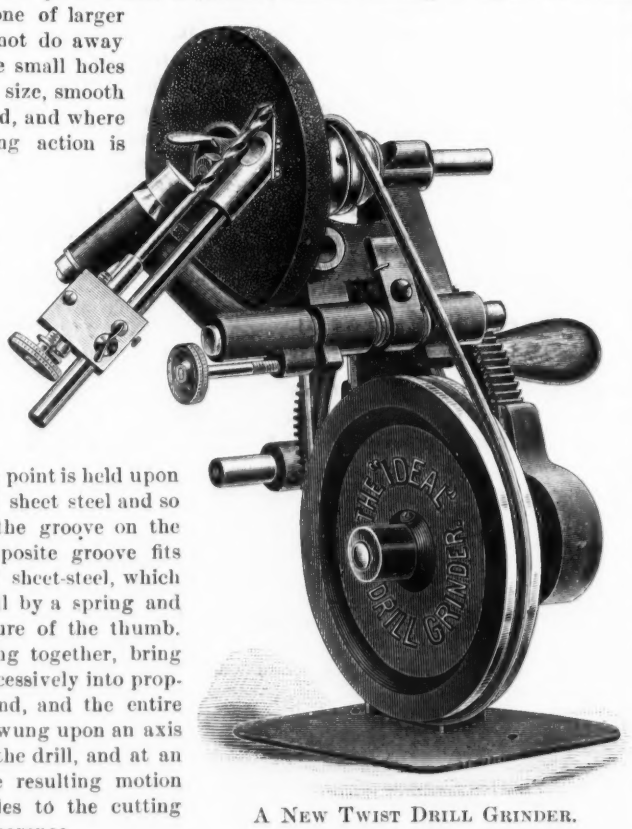
A New Twist Drill Grinder.

The advantages of twist drill grinding machines, and the use of them, over hand grinding, are now so well understood that it is almost unnecessary to refer to them; but there are many shops in which, while it is recognized that such grinders are a necessity where the best results are looked for with the larger sizes of twist drills, this is not thought to be the case with the smaller sizes.

And it is true that there is less difficulty usually in getting a reasonably satisfactory performance from a hand ground drill of small size than from one of larger diameter; but this does not do away with the fact that where small holes are wanted to be true to size, smooth and generally well drilled, and where the best possible cutting action is wanted with the greatest possible economy in the use of small drills, a machine of some kind is one of the requirements.

We illustrate with this a machine which has been designed especially for small drills. The shank of the drill is held in a female center, while the point is held upon a rest which is made of sheet steel and so formed that it enters the groove on the lower side. In the opposite groove fits another piece made of sheet-steel, which is held down to the drill by a spring and is released by the pressure of the thumb. These two pieces, acting together, bring the lips of the drill successively into proper position to be ground, and the entire holding device is then swung upon an axis which is at the side of the drill, and at an angle to it so that the resulting motion gives the proper angles to the cutting edges and the proper clearance.

All necessary adjustments of the drill with respect to the wheel can be made after it is clamped in place, and, in grinding, the entire drill-supporting device can be swung across the side of the wheel upon the axis below, which is parallel to the wheel arbor, thus avoiding grooving of the wheel and securing a straight lip. The machine, as shown, is intended to be turned by hand, but they are made to be driven by power or by hand, as may be preferred, by Mr. Thomas Hall, 853 Broadway, New York.



A NEW TWIST DRILL GRINDER.

Points Obtained from a Machine Shop in Hartford.

BY JARNO.

The first look at a pair of templates, upon trying them together, sometimes conveys an exaggerated impression of their inaccuracies. We have just had a question as to the amount of inaccuracy in a pair of templates.

This leads me to speak of the following principle: Two templates, each having the same variation in both directions from a given outline, may, when placed together, high points touching, have open spaces at low points equal to four times, or even eight times the variation. For example, two templates that at any point do not vary more than a sixteenth inch from a given outline, may be placed together upon their high points, and have spaces at other points a quarter inch, or even a half inch wide. Thus, in Fig. 4, let two templates *A* and *X* be cut to vary not more than a sixteenth inch from the given lines *C D* and *E F*. An inspection will show that while *A* touches *X* at two high points in each, there is a quarter inch space at *G*. Now if we rock one template upon the other until they touch at their ends *e* and *c*, Fig. 5, we shall have a space at *g* a half inch wide. Of course the same proportion holds for any amount, and it is when the variation is so small as one one-thousandth of an inch that we are likely to have exaggerated impressions of the inaccuracy.

The variation from the lines *c d* and *e f*, Fig. 5, remaining the same, the shorter the distance from the point *h* to the end *e*, the wider will be the space at *g*. If the templates are not much curved, a misleading exaggeration is not likely to come in this way; but when they are curved as much as those in Fig. 6, one template, as *P*, in closing up a space as *n o*, can swing through a greater distance than *n o*, and, in consequence, the inaccuracy can appear still more exaggerated. Thus, let the required outline be along the dotted line *J S*, and let the templates vary from it, one to *J n*, and the other to *J o*. Now the greater distance between the templates is *n o*, the sum of the two variations; but in rocking *P* upon *Y*, at the points *J K*, the point that reaches *O* is not *n*, but *l*, and the angular movement of *P* is not indicated by *n o*, but by *l o*, which is longer than the width of the space at *n o*. The open space *n o*, Fig. 6, has been closed in Fig. 7, and in its stead we have the wider space *L O*. The arc *L O* is of the same number of degrees as *l o* in Fig. 6.

In turning pieces in a lathe, time can be saved by having a stop to run the carriage against, and turn each piece at only one place before changing the stop. The stop can then be changed, and each piece turned at another place. In order to do this it may not be necessary to have the shafts exactly the same length, but their center holes should be countersunk to a stop, so that, when any piece is put in the lathe, the distance between the head-stock center and the tail-stock center will remain the same. This brings the shafts the same length between shoulders: if the lengths of the shafts vary, the variation is in the first turned place at the ends, which is usually either for a bearing or for a thread, and can be allowed to vary.

Order is one of machine shops' laws. The manner of a shop's carrying it out is one measure of success. As a help to having tools returned to their places, we put marks upon the tools themselves to indicate the places where they are kept. It is quite as important to have tools indicate their places as it is to have places indicate their tools. We, of course, have a book in which we keep a list of tools, their uses and their places, so that we can find any tool in the tool room if we know its name. When it is found, we do not have to refer to the list in order to return. I treat tools the same as I did my dog when I gave him a collar to tell his residence.

The Scope of Municipal Undertakings.

A committee of the Boston Merchants Association has recently made a report upon the local transportation problem of that city, in which the principle contended for by *The Engineering Record* has been recognized—namely, that the construction of a rapid transit roadway in an old and densely populated city, with heavy buildings and high land values, can be dealt with fully, adequately and economically only by the municipality itself. The recommendations of the committee, headed by Hon. Jonathan A. Lane, favored the construction of a tunnel road through the most crowded and valuable part of the city, but insisted that the work should be done by the city with a view to the serving of the general public, rather than to the accommodation of the existing railways with which connection would be made. This view, while apparently a surprise to some of the sentiment of Boston as reflected in its daily press, must be considered as embodying the only logical conclusion which a close study of the premises will justify. Equally with the provision of an adequate water supply and means for the disposal of sewage, the creation of an ample avenue of travel for the accommodation of the swift tide of population surging through and across large cities is a legitimate matter of public undertaking, especially as in the case under consideration, where heavy expenditure must be incurred with the prospect of returns not in the immediate future. It should not be necessary to point out the necessity of keeping such an important undertaking as an urban rapid transit road, like the one under consideration, out of the domain of politics and reckless speculation; the country is filled, though, with examples of important public works built by commissions of public-spirited citizens, whose undertakings have been alike a credit to themselves and to the communities they have been called to serve.—*Engineering Record.*

We have received the new catalogue of the Case School of Applied Science, of Cleveland, Ohio. This is a school which is doing a good work for the youth of Cleveland, and the catalogue shows it to be in good condition, and under the management of men who will be very apt to see that it remains in good condition. The courses of instruction are of a very practical nature, and well calculated to help young men along in preparation for life's work.

Insurance companies put exorbitant rates on the lives of express messengers. The holding up of trains, and the targets that express messengers make for the fellows who hold them up, has come to be an item in the business of insurance that the companies are bound to take account of.

Improved Packing Extractor.

An improved packing extractor, adapted to all kinds of stuffing boxes, is shown in the accompanying illustrations. It is designed to facilitate the extraction of worn-out packings without injury to the stuffing box, gland or rod.

This extractor consists simply of a bushing *A*, screwed into the stuffing box *D*, as shown in Fig. 1. The bushing *A* is made in two sections, the joint running longitudinally, as shown in Fig. 2. The tongues *B* on one section fit nicely in corresponding grooves in the other one, so as to prevent any longitudinal displacement. When the two sections are put together, they form a complete receptacle for the packing, which is pressed against the rod *G* in the usual manner by means of a gland *E* and cap *K*. The outer end *H* of the bushing is made hexagonal or square, so that a wrench can be easily applied for screwing the bushing in or out of the stuffing box. The ring *J*, placed in the annular groove in this end of the bushing, is for the purpose of holding it true.

The advantage of this device will be readily perceived by referring to Fig. 2. When the packing is to be extracted, the bushing is screwed out of the stuffing box, and the sections of bushing are taken apart, thereby exposing the packing, which may then be easily removed, or only that portion which is worn or burnt need to be taken off, and the remainder used again in connection with the new portion.

This extractor has been in use for the past year on the valve stem of a marine inverted vertical non-condensing engine, built by the Astoria Iron Works (Oregon). It is highly spoken of, and is considered to be a thoroughly efficient and labor-saving device.

These extractors are made in several modified forms, one of which is shown in Fig. 3. In this design the bushing is not screwed into the box, but it is held in place, or removed, by means of the gland bolts *L*. The tapered ends of the bushing serve to press the sections tightly together.

This extractor is not only adapted to hemp or any other kind of fibrous packing, but can be used with advantage in connection with metallic packing, and is well suited for engines in which the surrounding mechanism does not permit the use of ordinary tools for removing the worn-out packing. The above is the invention of Mr. Addison Goodrich, Box 683, Astoria, Oregon.

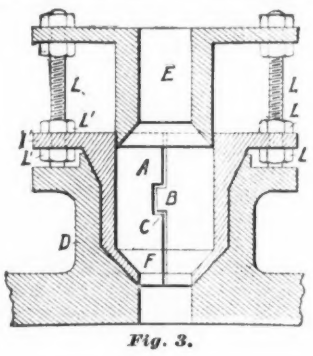


Fig. 3.

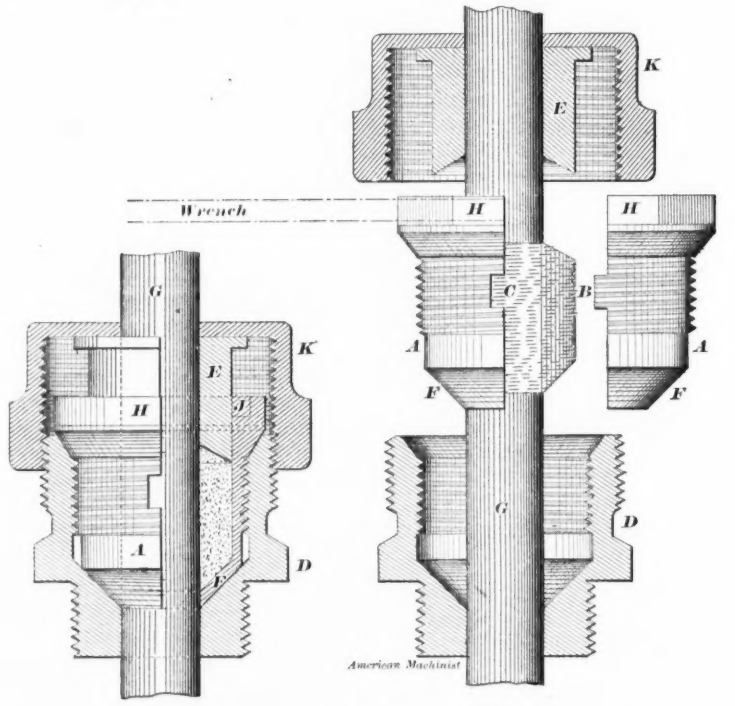


Fig. 1. *Fig. 2.*

IMPROVED PACKING EXTRACTOR.

Rifle Curves.

BY FREDERIC R. HONEY, PH. B.,
INSTRUCTOR AT TRINITY COLLEGE.

The curve giving the direction of the groove in a rifled barrel is constructed by plotting it on the interior surface when it is developed on a plane. This developed surface is then supposed to be bent into the cylindrical form, giving the "twist" to the line, and the construction is made in the same manner as explained in the article, "Variable Pitch."

The "uniform twist" is the common helix having a very coarse pitch, *i. e.*, one making a small angle with the axis (about 6°). In this case the line *o a* (Fig. 1) on the developed surface is straight. The angle Θ is that which the helix forms with the axis, and is here very much exaggerated, in order that the work, both in this and the succeeding figures, may be clearly shown within the limits of these columns. In Fig. 2 we have the elevation of the helix, and it is represented upon the surface of a cylinder, which may be supposed to fit the barrel. Fig. 9 gives the uniform twist on a smaller scale, the helix forming with the axis the usual angle.

In order to give rotation to the projectile gradually, a curve is frequently employed. In Fig. 3 the curve is the arc of a circle, the tangent at the point *o* being parallel to the axis of the barrel. If this curve be substituted for the straight line, the direction of the path of the projectile will gradually change from the breech end, where it is parallel to the axis, to the muzzle end, where it may form any assigned angle with it. Fig. 4 shows the elevation of this curve when the envelope is wrapped around the cylinder. The length of the radius with which the circle is described is equal to the length of the rifled part of the barrel multiplied by the co-secant of the angle which the tangent to the circle at the muzzle end forms with the axis. For, let y represent the length of the barrel; then R (the radius of the circle) $= y \times$ secant $(90° - \Theta)$.

The common parabola (Fig. 5) has sometimes been employed in constructing the curve. The equation is $y^2 = a\,x$ [I].

To plot the common parabola. Making the constant $a = 96$, the equation becomes $y^2 = 96\,x$. On the axis of X lay off from the origin the unit measurements 0 — 1, 1 — 2, etc. Through 1, 2, etc., draw ordinates parallel to the axis of Y.

Making $x = 1 \therefore y^2 = 96 \therefore y = \sqrt{96} = 9.8 = 1\,p'$,

Making $x = 2 \therefore y^2 = 192 \therefore y = \sqrt{192} = 13.85 = 2\,p''$, etc.

The curve $o\ p'\ p''$, etc., traced through these points, is that part of the parabola which, when the envelope is wrapped around the cylinder, gives the elevation, Fig. 6.

We will suppose that we wish to find the equation of the curve when the condition is imposed that its tangent at a shall form with the axis an assigned angle Θ. In Equation [I] we have to find the value of the constant a.

Differentiating, $2\,y.\,dy = a.\,dx$,

$$\text{or, } 2\,y.\,\frac{dy}{dx} = a.$$

Now $\frac{dy}{dx}$ is equal to the tangent of the angle which the tangent to the curve makes with the axis of X.

$$\therefore a = 2\,y.\,cot.\,\Theta.\ [II],$$

in which y is equal to the length of the rifled part of the barrel; for we are considering the ordinate of a, the most extreme point of the curve.

The number of turns in a given length of barrel depends upon the angle which the tangent to the curve at the muzzle end makes with the axis.

If we decide that there are to be a given number of turns, we ascertain the value of Θ as follows:

Let d = diameter of bore.
" n = number of turns.
$\therefore x = n\,\pi\,d$,

and Equation [I] becomes $y^2 = a\,n\,\pi\,d$;

$$\therefore a = \frac{y^2}{n\,\pi\,d},$$

in which, y being known, a is easily computed, and from Equation [II] $cot.\,\Theta = \frac{a}{2\,y}$.

The semi-cubical parabola [Fig. 7] is frequently employed. Its equation is $y^{\frac{3}{2}} = a\,x$ [III]. Fig. 8 gives the form on the surface of the barrel.

The following practical example will illustrate the method of plotting the semi cubical parabola. The equation of the curve [Fig. 10] is $y^{\frac{3}{2}} = 123\,x$ [IV]. Each of the measurements 0 — 1, 1 — 2, 2 — 3, etc., represents 10″; that is, 0 — 6 represents sixty inches full size. Substitute 10″, 20″, 30″, 40″, 50″ and 60″ for y in Equation [IV]. Thus,

$10^{\frac{3}{2}} = \sqrt{10^3} = \sqrt{1000} = 31.62 = 123\,x;$

$\therefore x = \frac{31.62}{123} = 0''.26 = 1 - p_1$

$20^{\frac{3}{2}} = \sqrt{20^3} = \sqrt{8000} = 89.44 = 123\,x;$

$\therefore x = \frac{89.44}{123} = 0''.73 = 2 - p_2$

$30^{\frac{3}{2}} = 123\,x;$

$\therefore x = 1.34 = 3 - p_3$

$40^{\frac{3}{2}} = 123\,x;$

$\therefore x = 2.06 = 4 - p_4$

$50^{\frac{3}{2}} = 123\,x;$

$\therefore x = 2.87 = 5 - p_5$

$60^{\frac{3}{2}} = 123\,x;$

$\therefore x = 3.78 = 6 - p_6$

As in the common parabola, if we wish to find the equation when the tangent at a forms with the axis an assigned angle Θ, differentiate Equation [III]. Thus

$$\tfrac{3}{2}\,y^{\frac{1}{2}}.\,dy = a.\,dx,$$

$$\text{or, } \tfrac{3}{2}\,y^{\frac{1}{2}}\,\frac{dy}{dx} = a.$$

Substituting the value of $\frac{dy}{dx}$ $[= cot.\ \Theta]$,

$$a = \tfrac{3}{2}\,y^{\frac{1}{2}}\,cot.\,\Theta\ [V],$$

in which, as before, y is equal to the length of the rifled part of the barrel.

Also, if the number of turns be given $[= n]$, and we wish to find Θ, Equation [III] becomes $y^{\frac{3}{2}} = a\,n\,\pi\,d$,

$$\therefore a = \frac{y^{\frac{3}{2}}}{n\,\pi\,d},$$

and from Equation [V] $cot.\,\Theta = \frac{a}{\frac{3}{2}\,y^{\frac{1}{2}}}$ [VI].

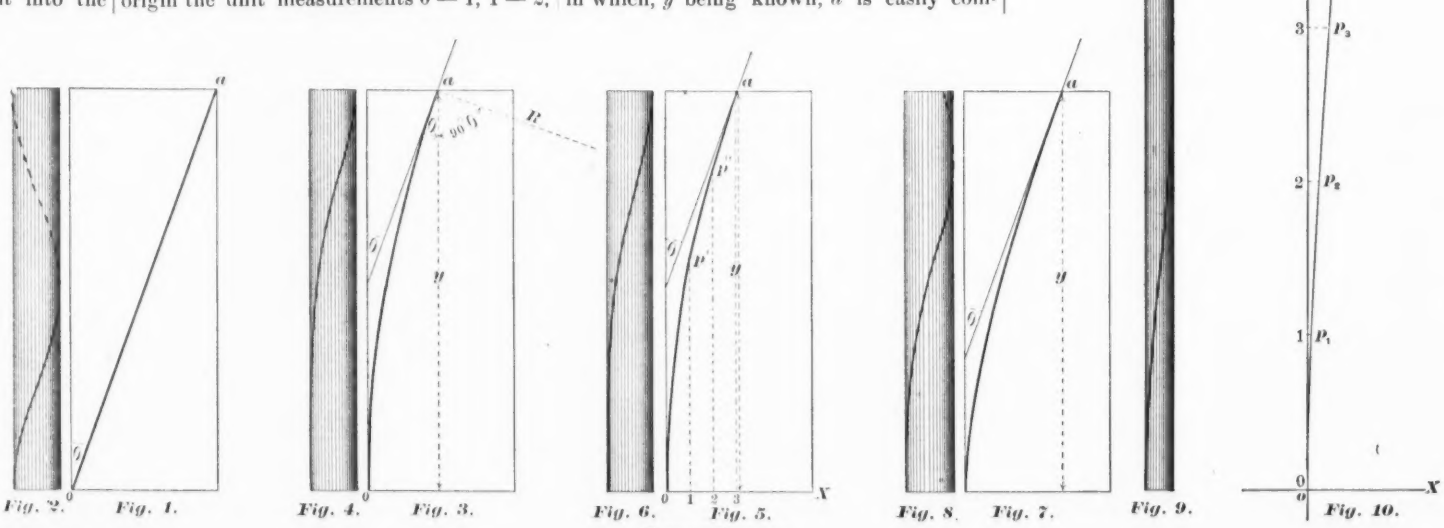


Fig. 2. *Fig. 1.* *Fig. 4.* *Fig. 3.* *Fig. 6.* *Fig. 5.* *Fig. 8.* *Fig. 7.* *Fig. 9.* *Fig. 10.*

RIFLE CURVES.

The Pennsylvania Railroad claims to have broken the record in time between New York and Washington, covering the distance —228 miles—in four hours actual running time.

Hudson River Bridge.

Herewith we give an illustration of the proposed plans of a bridge over the Hudson River, between New York City and the State of New Jersey. The plans were submitted by J. W. Balet, engineer, 261 Broadway, N. Y., who also offers the following explanations and description, which, no doubt, will be read with interest.

I have calculated and constructed a bridge according to my system, of which I beg to lay before your board of directors an elevation with a description which will give a general idea of the structure, and I am ready to appear before said board to give a full explanation of this subject.

It may be useful to repeat in this letter the peculiarities of this system and its advantages, which will make the meaning of the following explanation better understood.

The suspension cable, as developed till now, offers, "notwithstanding its efficiency as a supporter of heavy loads over large openings," an obstacle, which, especially for this bridge, "same being intended for heavy railroad traffic, which means concentrated heavy loads," would make its adaptation a matter of serious reflection.

A cantilever bridge will answer the purpose; but to give an idea what will be the weight of a cantilever, I refer to the Firth of Forth Bridge.

Your bridge is 4,550 feet long, and has eight tracks; the Forth Bridge is 5,400 feet long with two tracks, and for its construction there has been used 42,000 tons of steel; that is, $3\frac{8}{10}$ tons per foot per track, or $7\frac{6}{10}$ tons per foot for two tracks, and with these figures for example, it does not require much explanation to prove that the Hudson River Bridge cannot be constructed as a cantilever bridge with two tons of steel per foot per track; but taking two tons as a possibility, the bridge would weigh 72,800 tons, which is more than twice the weight required for my system.

In my construction I unite the efficiency of the suspension cable with the rigidity of the cantilever bridge.

Fig. 1.

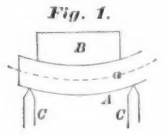


Fig. 2.

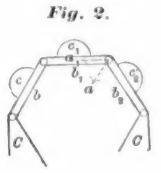


Fig. 3.

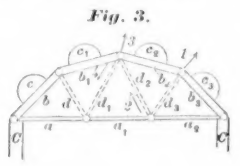


Fig. 4.

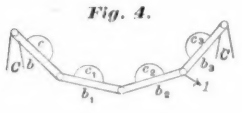


Fig. 5.

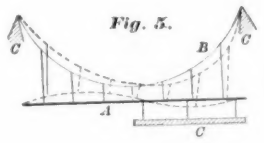


Fig. 6.

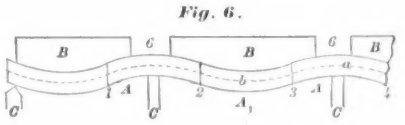


Fig. 7.

Fig. 8.

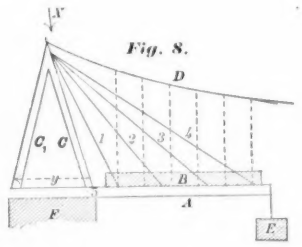
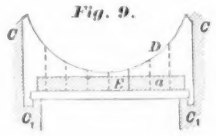
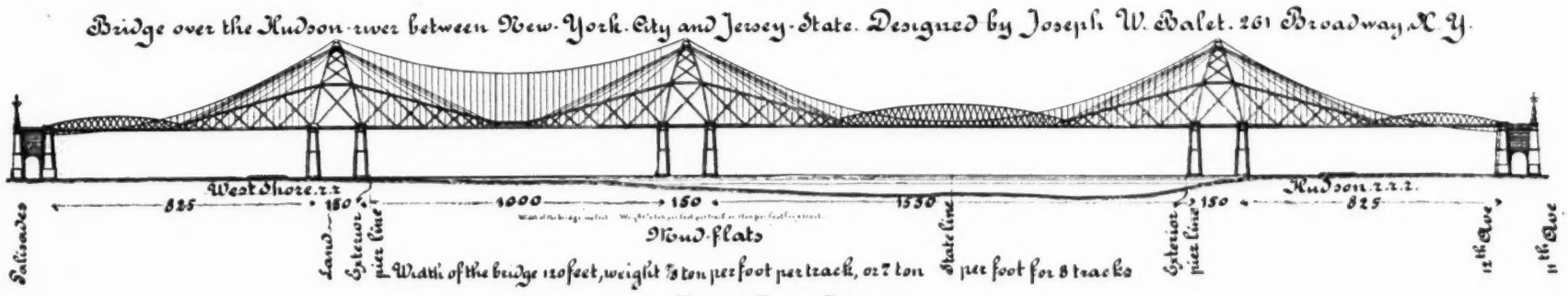


Fig. 9.



Bridge over the Hudson river between New York City and Jersey State. Designed by Joseph W. Balet. 261 Broadway N. Y.



HUDSON RIVER BRIDGE.

The use of the tension cables is optional, because the cantilever can be constructed so much heavier as to be able to carry the strain which these cables have to withstand; the application of said cables, however, gives economy in the use of material; but this is only of secondary importance; their main advantage is *that they will facilitate the work of mounting the bridge.*

A structure of this magnitude, over which will pass a heavy traffic, requires a particular design to make it answer the purpose.

To understand this well, the different means which the engineer has at his disposal are first described with an explanation what forces are at work on a bridge to destroy it.

In Fig. 1 is shown a beam A, carrying the load B. In this beam two forces are at work to break it. First, the weight of the beam; second, the load B.

These forces increase, first, when the distance of the supports C is increased; second, when the load B is increased; and both make a heavier beam necessary, which is a third increase. In the center of the opening the beam has to withstand the greatest strain, and this strain decreases towards the supports C. Where the greatest strain is, the most material is required to withstand it, and the beam must be the heaviest in the center. The strain which the beam has to withstand will bend it as shown, the underside becomes longer, and the top becomes shorter. But an object cannot become longer without pulling it, neither shorter without pressing it. In other words, the underside is pulled and the top is pressed. Now, the transition from pull to pressure is gradually, and there must be a place where is neither push nor pull, that is, on the line a, and no material is wanted there to withstand the longitudinal strain. It will be understood from the foregoing description that the deeper the beam is the less will be the material required at the top and underside.

Fig. 2 is composed of three links b, which are pivotally attached to each other and supported by the supports C; each link has to carry a load c, as shown. The load c_2 has a tendency to push the link b_2 down as the arrow a indicates; but to go down it must push the link b_1 away, as the arrow a_1 indicates. The link b has the tendency to push the link b_1 in the opposite direction of the arrow a_1, and the links with their loads balance each other. Suppose the load c removed from the link b, and instantly the balance is broken and the links fall down.

In Fig. 3 are shown four links b, carrying the loads c, and, to prevent the links from spreading, the end links b, b_3 are connected by the links a. As explained in Fig. 2, the links b balance each other. Now, suppose the load c_3 removed, then the links will move in the direction of the arrow 1. To prevent this movement, the link d_3 is added. The movement is, however, not stopped, but it is only transmitted to the links d_3, a_1, which will have a tendency to move in the direction of the arrow 2, and to prevent this, the link d_2 is added; this does not stop it, either, but transmits it again to the links d_2, b_1, as the arrow 3 indicates. Now the link d_1 is added, which transmits it again, the link d transmits it again, and the link b brings it over upon the support, and the movement of the links is prevented. The links d only do work to keep the links b in equilibrium when the load is removed from one, two or three links b; when all the loads c are removed, the links b balance each other again. What is described here is a simple representation of the action of a railroad train upon a bridge. When all the links b are loaded, the links a and b are subjected to the greatest strain. When the load upon the links b is uniformly divided over the opening between the supports c, the links b will balance each other when the pivots of said links lie in a line known by the name of parabola. The links b are pressed and the links a are pulled. When the links b and a are parallel straight lines, as for instance in a parallel girder, then equilibrium of the links c is impossible, and the diagonal links a are always strained. In place of placing the loads c upon the links b, they may be placed upon the links a, which changes the condition to that extent that the diagonal links have to transmit the strain of their loads to the links b.

In Fig. 4 the links b are reversed, and now they hang between the supports C. When now the load c is removed, the links will have a tendency of moving in the direction of the arrow 1. Now, suppose said links made very short and their number increased, and "in place of pivots" united by flexible wire; or supposing the links made of flexible wire, or, better, the links and their connections replaced by a bundle of flexible wires, and we have arrived at the suspension cable, and all that was said before of the links is true of the suspension cable. Transportation over the curved cable would be impracticable, a level road is wanted for the purpose, and therefore a level road A is hung upon the cable B (see Fig. 5). This road will follow any change in the curve of the cable, and there are only two conditions under which the road is level, viz.: when the road carries no load, and when the road is evenly loaded from end to end. Now, supposing the bridge loaded by the load C, and the rest of the bridge unloaded, then the bridge will undergo a change in form which is indicated by the dotted lines in Fig. 5, and the wider the opening and the more concentrated the loads, the deeper the road bed will sink, and, as experience has taught, this may prove to be disastrous.

Different devices have been applied to prevent this; none, however, effectually stop it, and the difficulties arising from this inconvenience proved an obstacle for the application of the cable for large bridges over which a heavy traffic has to pass, notwithstanding the cable is pointed out for bridging over openings where no other structure is feasible.

Fig. 6 shows a beam A, laid upon three supports C, and the loads B placed upon the beam. Now, the strain in the beam will give it a double bend, as is shown in the figure. The underside of the beam from 1 to 2 becomes shorter, from 2 to 3 becomes longer, and from 3 to 4 becomes shorter; in other words, the underside of the beam from 1 to 2 and from 3 to 4 is pressed, and the underside from 2 to 3 is pulled. The top of the beam is the reverse. The change from push to pull is gradual, and there must be places where is neither pull nor push; these places are here marked with 1, 2 and 3, and the beam may be cut through at these places when a provision is made to prevent the piece A_1 from falling down, which is obtained by laying A_1 on top of the beams A and A_2, which Fig. 7 shows.

This is the principle of the cantilever bridge, and the attentive reader has already observed the advantage of the cantilever bridge over the girder, viz, the plans 2 and 3 being at one-fourth of the opening from the supports C, the girder A_1 has only one-half of the length of the opening, consequently, when Figs. 1 and 6 are compared, the same beam can span an opening which is twice as wide as in Fig. 1 when the beam is strengthened above the supports C. In the cantilever the application deviates from these dimensions, for reasons of construction or other reasons, but the advantage still remains, and where a common girder becomes too heavy, a cantilever bridge may be still feasible as again the central line, where there is neither push nor pull, and the places in the beam which must withstand the biggest strain and require most material, the beam is heaviest in the center and above the supports. But the cantilever bridge even has its limits. To understand the meaning of this, we only have to remember that two forces are at work to destroy the bridge, as explained before. Now, supposing a bridge designed, and calculations show it not to be strong enough, more material is added to the construction to make it stronger. This, however, increases the weight of the bridge, and when the addition of material is made it may be that the bridge is not strong enough to hold its own, or the additional weight, and there is the limit. Now, therefore, the further we remain from this limit, the lighter and stronger the bridge will be. A bridge is never made so as to be just able to carry its load, but to carry three or four times that load; this is known by the name of coefficient of security. Now, suppose the limit is nearly reached, a margin may again be obtained by reducing the co-efficient of security, while the same will reduce the weight of the bridge, and *vice versa*, the lighter the bridge can be built the more good this coefficient of security will do, and the larger the proportion of the contribution of this coefficient of security towards any extra load or strain upon the bridge.

In Fig. 8 the beam A is fastened to the piler F, and the load B is placed on the beam. When now the beam A has not sufficient strength to carry also the load E, which is hung up at the end, a provision has to be made to help it. For this purpose the ropes 1, 2, 3 and 4 are fastened to the frame C_1, C and the beam A, and when the frame C, C_1 is well fastened to the piler F, or when a force X is applied on top of the frame to prevent the structure from dipping, it will be strong enough to carry the two loads.

Now, the force X is the weight of the structure, and the point 5 being the center around which the structure would topple over, y has to be so large that the leverage of the force X balances the leverage of the loads B and E. The rope 1 is strained the least, and the rope 4 is strained the most by the weight E, and a portion of the strain of that weight is transmitted through the beam

A to the ropes, 3, 2 and 1. Now, suppose all four ropes of the same strength, then the rope 3 will be the strong, 2 will be stronger still, etc., but the surplus strength of these ropes may be made useful by making the beam A at those places lighter, and in proportion as the beam is made lighter these ropes have to carry a smaller or larger portion of the load B, or the weight of the beam A.

When Figs. 7 and 8 are compared, it will be seen that the beam A, in Fig. 8, represents the cantilever A, in Fig. 7. The load E, in Fig. 8, represents the pressure of the girder A^1, in Fig. 7 upon the cantilever A.

In Fig. 9 the beam A over-spans the opening C^1, C^1, and the load E is placed upon it. Now, suppose the beam A not strong enough to carry the load E and its own weight. To help the beam, the rope D spans the opening C, C, and the beam A is hung upon the rope D, and also supported at C^1, C^1. Now, the dimensions may be so chosen that the beam is able to carry the load E and the rope to carry the weight of the beam A. When now, for instance, the portion a of the load E is removed, the strain in the beam and the rope are changed, but they will retain their form, and now the change in the curve of the rope is effectually prevented. But a beam capable of carrying an evenly divided load is heaviest in the center, as was explained in Fig. 1, and when the distance between the supports is large the difference in weight of the beam A in the center and at the ends is considerable. Now, in place of the beam A, a cantilever bridge may span the opening, and when the proper dimensions are given to the component parts the weight in the center is diminished to that extent that the weight per foot closely approaches a uniform weight. In Fig. 8 is shown how the cantilever is hung upon the rope D, and the beam A may be made lighter in proportion to the carrying capacity of the rope.

Now, when we look at the elevation of the bridge we see the different elements which have been described put together, and a short description of the bridge will finish the explanation.

The underside of the bridge is 150 feet above high water, and the top of the rails 154 feet. The openings are wide, beginning from New York 900 feet, 1,700 feet, 1,150 feet and 900 feet. These large openings were necessary, because no obstruction should stand in the channel of the river, but a pier on the Jersey flats would be a benefit to vessels navigating the river, because it would be, practically, a lighthouse. The bridge is 120 feet wide, has 8 tracks, and is composed

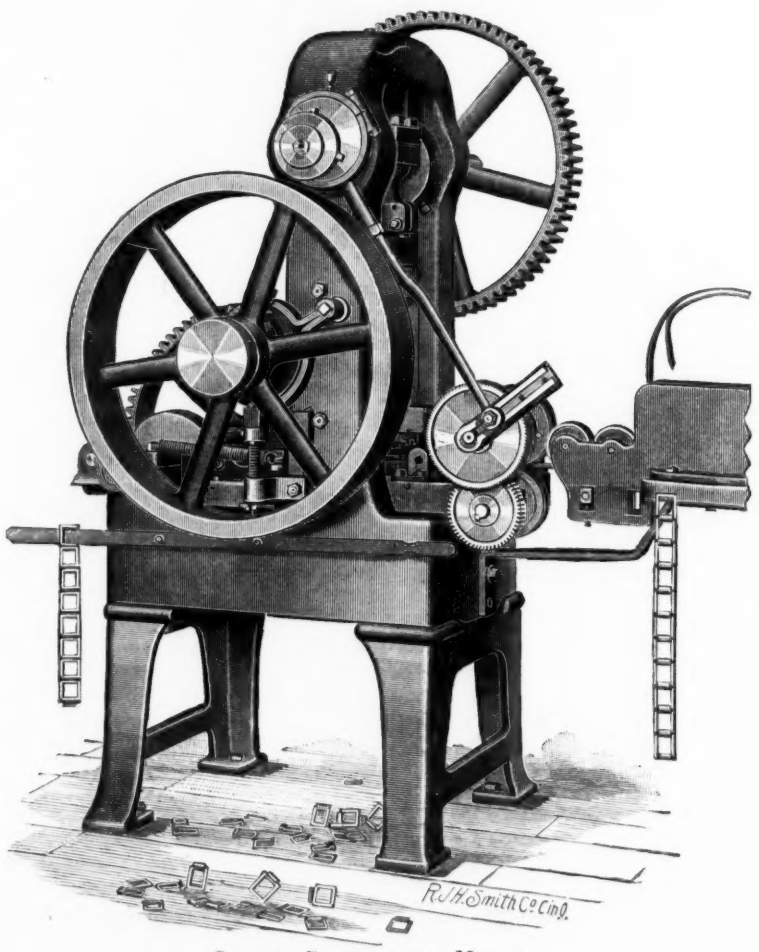
5 girders and 8 suspension cables, and the whole so constructed as to be able to carry a load of 14,400 tons, which will never be upon it at the same time. The coefficient of security is 3 and 4, depending on the importance of the detail and the nature of its strain. In addition to this it has an extra system of girders, to withstand the wildest hurricane. The cables are composed of 3,721 steel wires, of $\frac{5}{16}$-inch diameter. Of these 3,721 wires, 192 are necessary to withstand the extra strain to which the cables are subjected in very cold weather. The remaining wires are necessary to carry the girders, road-bed, etc. The weight of the 8 cables is 5,400 tons. The weight of the girders is 23,000 tons, in which is also a surplus to take up the extra strain in very hot weather. The average weight of the bridge per foot and per track is $\frac{7}{8}$ ton, or 7 tons per foot for 8 tracks, and its total weight is 32,550 tons. When the opening of 1,700 feet carries a load of 40,000 tons it sinks 14 inches, and a change in temperature of 100 centigrades, or 180 degrees, raises or sinks it 12 inches.

Mr. Swan, Secretary of New York and New Jersey Bridge Company, says that "the plan presented by Mr. Balet would be referred to the board of directors and the Chief Engineer, Mr. Clarke. Other plans will be presented and all plans will be considered. The company wants to make a structure which will be of great benefit to all the railroads and the public. It is proposed to have a plan that will meet the views of the War Department, and be a monument of modern engineering. The corporation feels sanguine that all of these requirements will be secured. The aim of the company is to concentrate all the railroads coming from the East, West, North and South in one great Union Depot, and build the bridge without obstruction to river traffic, and the approaches thereto without obstructing the streets of the city of New York, and by that means land passengers in the heart of the city. Time will be taken, and no means will be lacking to secure the best plans, not only for the bridge, but for the approaches, depot and connections. The plans for the Union Depot will be such that the postal authorities can have all the room they need for the great central distributing post-office."

Special Chain-making Machine.

We illustrate herewith a machine recently constructed by the Toledo Machine and Tool Co., of Toledo, Ohio, for making a special form of chain out of sheet-steel, the machine being built to order for the Dayton Steel Chain Co., of Dayton, Ohio.

The machine has two plungers, both driven through the medium of gear wheels from the fly wheel shaft, one plunger being vertical and the other horizontal. The material comes in strips, and is automatically fed to the machine by rolls, which are moved by an eccentric working a ratchet and pawl feeding device, which feeds during the up stroke of the punch. The vertical slide carries the punch, which, as the stock is fed forward, first perforates or removes the central part of the link, after which it is again fed forward, and at the next downward stroke the link is formed, and the end turned down. At the same time the horizontal slide at the back comes forward, and completes the link by the formation of the hook, a complete link being made at each stroke of the machine, after the first stroke. The machine is designed to run at forty strokes per minute. Its weight is about 7,000 pounds.



SPECIAL CHAIN-MAKING MACHINE.

A correspondent of the *Evening Post* objects to the request of "Step lively," which one is very likely to hear when boarding an elevated train. With only a fraction of a minute for a stop, it would, perhaps, consume too much time if an employe were required to take off his hat and explain to the entering passengers the importance of making haste in getting on the train. There is reason in most things in the world, if one will only see it.

LETTERS FROM PRACTICAL MEN.

Wants to Know How to Turn Shafting.

Editor American Machinist:

I always thought that the lathe would turn a round straight shaft, until I tried it. Now I have found it will do no such thing. I have believed that the people who built lathes could furnish shafting rests with their lathes which would turn any number, what the mathematican calls x, feet of round and straight shafts per hour. I have found that the value of x seemed to depend on the splendor of the lathe builders' catalogue. Please put down this, my present opinion, founded upon bitter experience, that I doubt if there is a shafting rest to be found in this country which will turn per day ten feet of round straight shaft of uniform diameter, using more than one tool.

Now I am a plain man, not even an engineer, but there is a trace of the bulldog in me, and I hate to give up. Still, I am beaten up to this moment, and I am feeling so low about it that I am willing to beg for help. Here is the problem: To turn shafts of from two to six inches diameter, and of from ten to sixteen feet long, and have them straight, round and true to size, so that you can slide a bush over the whole length without shake.

I would add that, being a plain man, I mean straight when I say it, not "wavy," nor "kinky," and when I say round I don't mean one-hundred-sided.

This is my best up to date. Starting with a very accurate lathe, I turn the shaft, without straightening (this means from one-half to three-quarters of an inch over size), to nearly the size, with a single tool, using very fine feed and great care. Then the shaft is filed about to the size and then lapped to the final size.

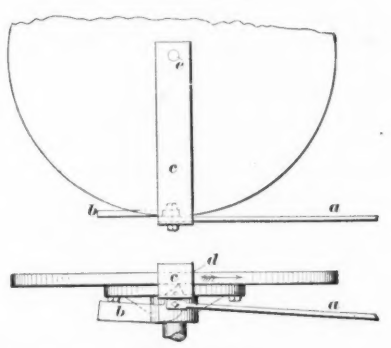
Some one may say that this is not turning at all. That's how it seems to me. Won't some kind engineer or mechanic tell me how to turn it, with a beautiful fixture for the lathe, using "racing feeds" and several tools so that I can finish ten feet per day? Now, I am free to allow that it takes me nearly three days to finish one ten-foot shaft.

Information on this subject seems to be wonderfully scarce. The other day I met one of the best known lathe builders in the country, and I just asked him the above simple question. That well was soon pumped dry. "I'd like a little time before answering." That's all *he* said. Then I tried to find out what a great big mechanical engineer knew on the subject. "Leave me alone; all I know is how to build a steam engine." That's all I had from *him*. Then I coaxed an opinion from a bright Worcester tool builder. "You can't do it one bit quicker or better than you are doing it now," he said.

Now, please ask some of your bright readers to shed a little more light on this simple work. Nothing could be simpler. All that I want is a straight, round bar of uniform size, about ten to sixteen feet long, from two to six inches diameter, turned, say, in ten hours. A 'prentice ought to be able to do it in the lathe that came out of the ark, but I give it up. I can't *turn* it. I can only file it and grind it.

Please give this your prompt attention, as the Monthly Statement says, or I shall send over to England for a Johnny Bull to teach me how to turn it in a yawning gap lathe. Don't put me to this bitter disgrace!

"PASSAIC."



Another Peculiar Job of Planing.

Editor American Machinist:

As November 12th issue came to hand containing article by "A Mechanic," headed "A Peculiar Job of Planing," it was of unusual interest to me. Having to keep up the machinery in a large woodenware works, where is in connection a small machine shop, containing one each of the principal tools and those of medium size, special rigs have to be resorted to quite often, as a big bill for machine work done outside the works would not speak approvingly to the company of the man in charge.

I had at the time a disk (or rather a plate bolted to a disk) to face, which was too large for my lathe. I was ruminating the easiest way to handle it when article referred to opened up another route; but I had the advantage of a good Lodge, Davis & Co. shaper; also the disk was to be used at one end of a wooden frame, face up. It was short work to bolt frame and all up in front of said shaper and proceed. I had only to face part way in from the edge. It took some longer than it would had it been done in a lathe; the result, however, was equally good.

I send sketch of the feed used, as it was an improvement over Jim T.'s method, and could as easily be used from the planer feed movement as from the shaper; rod a takes the place of the regular feed rod on shaper, and, being attached to dog b, as it moves in the direction of the arrow pulls plate and all with it, but returning, b rises, frees the plate, and carries c back with it, and so on, making an automatic regular feed, which, I think, is more than half of a special rig, since without a self-acting feed it is near impossible to get good results.

Pieces of wrought-iron from the scrap was the material, bent as shown. The dimensions are not important. A pin at e drops into a hole in the plate, which holds c in place, but it could have been kept in place several other ways as well had there been no hole in the plate, and necessary to cut clear to the center. A shim placed under c at d took up the slack produced by the first cut, and made dog b hang in the right position again for the finishing cut.

H. P. HOAG.

Cast-Iron.

Editor American Machinist:

The point the foundryman must first consider is the proper blending of the pig-irons given to the melter, to be used in the mix-

ture. Carbon hardens and injures some of its qualities, while sulphur will render it fusible, or hot short silicon hard and brittle, and phosphorous cold short.

Carbon in its combined state is a great deal more sensitive than graphite carbon.

In the mixture of irons calling for strength and density, I would advise no iron used of a higher grade that 2X, used with say No. 2 plain iron and scrap, if properly mixed. I am free to state that with this mixture you will obtain a clean and dense casting, that is, providing you do not cut into the pores of the iron, as we are aware that the deeper iron is cut into the more open it will be found.

Grey iron is one of the best brands to use, for the reason that it can be easily bored and turned, will not resist a file, will melt at a low heat, will preserve its fluidity much longer than white iron will, and does not clog up the ladles. It also contracts far less than white iron does, and will contain a much smaller percentage of cavities when cast to pattern.

Some few years ago the writer was called upon to make a steam hammer die for a large hammer, striking a fifteen-ton blow, they having had trouble in securing one that would last for any length of time. After making several tests in a crucible, I came to the conclusion that I was about right in the following mixture, viz.:

26¼	per cent.	Bessemer rails.
36	"	Charcoal iron.
12¾	"	Chateaugay iron.
25	"	Scrap.

With this mixture we secured a die that lasted several months, the tensile strain being 36,018. JAMES T. GOWAN.

Lathe Centers.

Editor American Machinist:

American practice differs from English practice in lathe centers in the angle to which they are turned. It is believed that the American rule is the best, for small work at least. The English requires that centers shall be 90 degrees in angle, and the American that they shall be but 60 degrees. The cause of this difference probably is that in English shops the workmen until recently were not provided with so many little conveniences as the American workmen were As a rule, they turn their centers to ordinary squares, while the Americans use the center gauge. This probability is marked when we remember that, before the use of center gauges became common, the square was frequently used in this country, and in fact is now used by foreign workmen, and by old, conservative Americans.

Sometimes it is not desirable to use a center as deep as one of 60 degrees would have to be to have the necessary strength; and, of course, in such cases other and blunter angles are necessary. This is the case where the center in the piece in hand must be turned or faced entirely off after its usefulness is ended, or in a case where the strain against a center is mainly an end strain, and where the side strain is but small.

The angle of 60 degrees on a center may be got with a pair of calipers if there is no center gauge to be had.

Set the calipers to the diameter *A B* of the center. Then, because the angle of 60 degrees is that of an equilateral triangle, the length of the sides *C A* and *C B* are equal to the diameter of the center. Therefore, when calipers thus set show that the center is as long on its taper sides as it is thick through, the angle must be the same as that of a center gauge.

In truing centers with turning tools where there are no grinding appliances these points may well be observed. They are not generally observed, and presumably are not as well known as they should be. Turn the tail-stock center first, and temper it, after hardening, to a dark straw color. But before hardening it cut a groove in it for the point of a side tool to enter in end facing or "squaring up" operations on a shaft. This sketch shows the groove, and its value is apparent.

Next turn the head-stock center very carefully, and, after hardening it, temper it to purple blue, just so it can be cut slightly with a hard hand tool. Then with such a hard hand tool turn it up dead true. Centers thus made are quite as good as those hardened and ground, for most purposes. *Never file a center.*

There is a great deal of work that may be done to advantage in female centers, such pieces as small taps and reamers, where the centers that are usually put in cut out so much space from places where strength is essential; pieces that are required to be finished to a conical point, such as ordinary handles, and pieces where the usual center

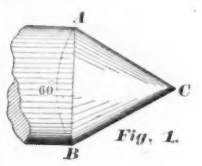


Fig. 1.

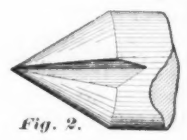


Fig. 2.

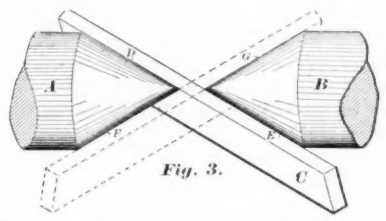


Fig. 3.

occupies a position where it either weakens or disfigures the piece. These, if practical, should be made on female centers, or on detachable centers.

It is much more difficult to make a female center true than it is to make true a male center. It cannot practically be ground, and must be true if for the head stock.

To determine with exactness whether the foot-stock center is in line with the head-stock center, this will be found to be a good rule.

After both centers *A* and *B* are known to be of the same angle, and as nearly opposite each other as ordinary means can show, place between them the thin parallel plate *C* in the position shown. Then when this plate touches the whole length along the sides *D* and *E*, and, reversed, touches the sides *F* and *G* equally well, the centers must be in exact line. It is obvious that this method furnishes as certain a means of detecting any variation in height between the head-stock and the foot-stock as it does of detecting the other alignment.

Again, it furnishes an excellent means of telling whether the foot-stock spindle is parallel to the seat of the foot-stock on the shears. For if this test be applied in all four positions when the spindle is within the foot-stock as far as it can go, and if it be tested again when the spindle is out to the extreme limit, it is evident that, if there be a variation, it will be shown between the parallel piece and centers, and magnified to double its extent.

The proportion of centers within a piece of work to its size is sometimes a very difficult question to decide, and must be left to the judgment of the foreman or other person in charge. But it may be said in a general way that centers in large pieces are more often made too small than too large. Thus an arbor is often centered to correspond to *its* size, and not to the work it is made to carry. And a piece two inches in diameter will have a center as large as one six inches in diameter when both are made by the same man.

A piece of work two inches in diameter should have centers in it about three-eighths of an inch in diameter, as a general thing. A piece one-half inch need not have centers more than one-eighth diameter ordinarily, while a center one inch in diameter may be safe in an arbor to turn a pulley on, three feet in diameter.

Yet, as has been said, it depends altogether on the character of the piece, its length, its weight, its regularity, the cut to be taken, and the quality of the work. It may be said that there are not many mechanics who study these essentials as they should be studied, but after they are studied it is surprising what improved results may be got. When a man begins to study centers he generally starts on a tour of study that never ends. But its effects may be observed in a very little time on his part of the pay roll.

In the turning of tapers, where there is no taper attachment to the lathe, centers have a very hard time of it. This especially is the case with the head-stock center, which will soon be twisted off if the taper be great. To overcome this defect there are many contrivances possible, and some of them are quite good, but most of them are expensive. The method seen in use in Massachusetts, of making each center point a hemisphere, is good, and cheaper than many a poorer contrivance. This does not necessitate the reaming of the piece in operation to fit; the usual taper hole generally is sufficient.

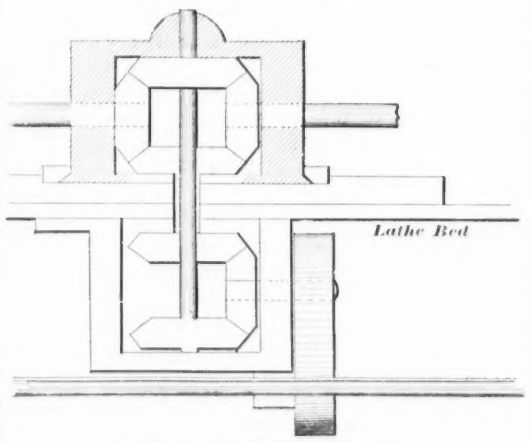
The making of correct centers in pieces to be turned in lathes is also important. The center in one end of a piece should necessarily be in exact line with the center on the other end, if the centers are reamed to exactly fit the gauge. This generally is not a practical thing to accomplish. So a center reamer may with advantage be made slightly concave, and shaped so that the centers made by it shall fit the lathe centers only at the larger diameters of the center hole in the reamed piece.

Arbors, if large, may be made from cast-iron if steel centers are put in them. The center pieces should be made of tool steel, and turned to be a shrink fit in the holes drilled in the ends of the arbors. The centers in these steel pieces must be reamed and finished before they are hardened, but they must be hardened before they are shrunk in. The cast-iron arbor must be heated no more than is necessary to expand it sufficiently to receive the center piece. After the center piece is dropped into place, put one or two drops of oil in the reamed center hole, then plunge the end of the arbor in oil before the center piece has had time to be drawn soft. If the heat is quenched in water, the steel center piece may be found to be loose when cold. A. D. PENTZ.

Revolving Turret Tools.

Editor American Machinist:

This week's issue has a description of a new turret head drill press, which is new and of interest to me—the more so as it embodies along with other things an idea of mine, which is shown by the inclosed tracing, which was made from an original sketch



REVOLVING TURRET TOOLS.

which I made and had hanging up in my room for some time at the works of the Central Chandelier Co., at Toledo, Ohio (for which firm I was tool maker), hoping to get Mr. Firth, the manager, to adopt it, as I believed it was just what was wanted on small brass work, and that it would soon have paid for itself. The sketch shows the idea, and will be readily understood, I presume. JOHN H. TAYLOR.

Labor Cost of Iron and Steel.

We have received the Sixth Annual Report of the Commissioner of Labor for 1890, which deals mainly with the cost of production of iron and steel here and elsewhere in all countries in which such industries are carried on. The report represents an almost incredible amount of careful and painstaking labor in its preparation, and is a most interesting volume. It should be placed in every library, and made accessible to every citizen interested in industrial matters.

Regarding pig-iron, it is shown by this report that its labor cost per ton in the northern States of this country is $1.62; its cost in hours of time being 11.4 hours. In the southern States the average labor cost per ton in money is $1.43, and in time, 12.86 hours. On the Continent the money cost is $0.64 per ton, and the time cost 12 44 hours. In Great Britain the money cost is $0.74, and the time cost 8.93 hours. The average labor cost of muck bar iron in the United States is, in money, $7.14, and in time 30.46 hours per ton. On the Continent the money cost, $1.74, and the time cost 25 64 hours per ton. In Great Britain the money cost is $3.37, and the time cost 28.33 hours per ton. The money cost of steel ingots in the United States is $1.66 per ton, and the time cost 9.79 hours. On the Continent the money cost is $0.71 per ton, and the time cost 12.24 hours. In Great Britain the money cost is $2.44, and the time cost 15.7 hours. The labor cost in money of steel rails in the United States is $0.68 per ton, and the time cost 8.16 hours. On the Continent the money cost is $0.53, and the time cost 27.17 hours. In Great Britain the labor cost in money is $1.48, and the time cost 12.2 hours. By "time cost" is meant the average number of hours of labor required for a ton of product. It is shown that wages here in these industries range from 2½ to 3 times those paid on the Continent, and about 1½ times those paid in Great Britain. The greatly superior efficiency of American labor in the steel industries, and especially in the production of steel rails, is a very notable feature of the report, though it is at the same time shown that we do not make so good a showing in respect to pig-iron, for which there are some good reasons, which are familiar to those acquainted with the industry. A great mass of information is also given as to the general condition of families, the heads of which are engaged in these industries, their income, expenses for rent, food, clothing, etc., and all this is very interesting, though a summary of it would be difficult, and also somewhat useless, since it must be evident that the total cost of living always bears a pretty close relation to the total income of such families. One of the most interesting features of this part of the report is a letter from the wife of a workingman, in which she relates in detail how she manages the household expenditures. It is a well-written letter, and throws a powerful light on the whole matter.

A systematic effort seems now to be under way to secure a proper representation of New York State at the Chicago Fair, and a bill has been drawn up for presentation to the Legislature, which provides for the appointment of a board of managers, who shall have direction of affairs connected with the matter. It also provides for the appropriation of $500,000, to be used as required for securing an adequate representation. Our opinions respecting the advisability of some such move were expressed in our last week's issue.

A correspondent writes us:

"I am a locomotive engineer and am thinking of going to Mexico to take a job of running on one of the Mexican roads. What do you think the prospects are there? I have a fairly good job where I am, but would like to see something of matters outside the United States."

Our advice would be, with a fairly good job, to stay right in the United States. If you get running a locomotive in Mexico the chances are that there as here—only a little more so—some accident will happen to your train in which life will be lost, then the probabilities are that they will hang you first and try you afterwards. That seems to be about the usual proceeding in that particular part of the world. If you have a good job where you are, it will probably discount anything you can get in Mexico.

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CONTENTS.

PAGE.

A New Shaper. 1
Standard Measurements in Machine Construction. By Fred J. Miller..... ..... 1, 2, 3
A New Twist Drill Grinder..... 3
Points Obtained from a Machine Shop in Hartford. By Jarno..... 3
The Scope of Municipal Undertakings.. 3
Improved Packing Extractor..... 4
Rifle Curves. By Frederic R. Honey, Ph B., Instructor at Trinity College.. 4
Hudson River Bridge..... 5, 6
Special Chain-making Machine..... 6
Letters from Practical Men: Wants to Know How to Turn Shafting. By "Passaic."... Another Peculiar Job of Planing. By H. P. Hoag....Cast-Iron. By James T. Cowan.... Lathe Centers. By A. D. Pentz ...Revolving Turret Tools. By John H. Taylor..... 6, 7
Labor Cost of Iron and Steel..... 7
A New York Central Collision..... 8
Marking Patented Articles 8
Literary Notes..... 8
Questions and Answers..... 9
Manufactures..... 9, 10
English and American Locomotives..... 11
A Machinist Paradise. By C. O. Sine..... 11
Combinations Pay.. 11
Machinists' Supplies and Iron..... 11

A New York Central Collision.

A collision occurred on the New York Central Railroad the other day at Fishkill Landing, which resulted in the killing of both the engineer and fireman, the coroner's jury finding that the accident was due entirely to the fact that the engineer disregarded the signals which were set at danger, while a switching engine was occupying the track upon the time of the fast express, which was a few minutes behind time and running to make up.

With the number of trains run over this road, and the speed at which they are run, the road should be equipped with the best known system of block signals, and when the financial ability of the road to have them is considered, it seems litttle less than criminal that trains should continue to be wrecked and men killed for the lack of them. It is true that it is claimed that the road is equipped with block signals, but the fact is that the system of signals in use is, taking the entire line into consideration, a conglomeration of various devices—good, bad and indifferent, the whole forming a system of signals which is really just no system at all, and which in very few places makes use of what have been demonstrated to be essential features of any efficient block signaling system. Except at certain points on the line, the signals do not interlock, and there are no distance signals. A large part of the line is supposed to be protected by a so-called system of signals devised by one of the officials of the road, which is little better than a farce, and which the engine runners know cannot be depended upon, and accordingly largely disregard, as indeed they must, in order to get over the road on time. These facts are very well understood by every practical and disinterested railroad man who has had an opportunity for observation of the road, though they are probably not understood by its highly ornamental president.

The dead engineer knew perfectly well that no switch engine had any business on his track on his time, and every one else who knows anything of railroading knows that, on a really well-managed road, it would not have been there, signals or no signals.

The fact is that the business of the road has outgrown its facilities in some respects, and it has also outgrown some of its officials. It is well known that it has in the past seldom, if ever, adopted an improved device, unless compelled to do so, its opposition to the Westinghouse brake and refusal to adopt it, until compelled to do so by the action of other roads, being well understood.

The road has one of the most valuable franchises in the world, and almost unlimited resources. It can and should be made one of the best managed and equipped roads in the world. It probably will be some day, but we fear not until many needless sacrifices of life have been made, nor until it has a president who has some other idea of the duties and responsibilities of his position than that it is a perpetual picnic, composed chiefly of banqueting, making addresses, and traveling in Europe.

Since writing the above, another still more frightful collision has taken place on the same road, by which twelve persons were butchered and many others injured, this being due directly to the absence of block signals and the fact that the rear brakeman failed to protect a standing train. It only emphasizes what is said above.

Marking Patented Articles.

We find in our English contemporary, *Industries*, the following words on the subject of the marking of patented articles:

One of the many practices in connection with patents which leads to serious abuses is that of stamping "patent" on manufactured goods. If a maker has a monopoly it is right to warn the public by stamping his goods, but it is also important, in the interests of the public, that he should not claim by implication monopolies to which he has no right. A man may make an engine of a type differing in several ways from those in use. The changes are, let us say, for the better, but are not new. He has a patent for some detail, which, as often as not, is lapsed as well as worthless, so he casts "patent" on the bed-plate of the engine, and the public does not know what is covered and what is not.

Another fraudulent practice is common, by which a patentee combines the advantages of a patent and a secret process. Suppose, for example, he makes a leather substitute. It is sold, say, and marked "patent," by some British Patent Leather Company. No one can find out the composition of the artificial leather by inspection or analysis. There may be some hundreds of patents for artificial leather, and it is impossible to find out which belongs to this particular maker. He may own half a dozen of the patents himself, five or perhaps six of which will not work. But if he has a genuine patent he gets a patent monopoly for fourteen years, and then goes on as long as he likes afterwards with what is practically a secret process.

The remedy for this condition of things is to enact that every patentee should mark his goods "patent," and should also add the number and year of his specification, so that the public may know what he is entitled to, and what he is not. It should also be punishable to mark articles "patent" after the patent has become void.

Broadly speaking, there can be no doubt that the public—in this country as well as in England—is entitled to know the facts regarding the patents that there may be upon an article, and we think that it would be an improvement if the law should require that there should be marked somewhere on every article covered by patents, the date and number of all patents applying to it, and it would be still better if it required that the particular part or parts of every machine which are covered by patents should be mentioned, so that they may be identified, and so that other manufacturers, inventors or others interested may readily see just what is and what is not covered by patents. We believe that this is a matter of somewhat more importance than appears at first glance, and that endless complications and trouble would be avoided by the change we propose. And above all else it would be just and fair, and would enable people interested to more easily know their moral and legal rights.

Almost simultaneously with the publication of sensational articles intended to show that electricity cannot be depended upon to kill murderers, and that if it does kill them it necessarily tortures them during the operation, there comes from New Orleans an account of the death of an unfortunate fireman, who, during a recent fire in that city, was first struck on the shoulder by a swinging telephone wire, which had been crossed by an electric light wire. The contact was but momentary, and, of course, was necessarily very imperfect. The wire rebounded, striking him again, and finally, upon his grasping it, as if to push it away from him, he instantly fell dead without a moan.

There have been too many deaths of this kind from electric light wires to admit of any reasonable person really believing that, with all the precautions known to secure ample current, with special arrangements made for securing perfect contacts, etc., there can be no certainty of instant and painless death by electricity. If such deaths are not secured (though there is no good evidence to show that they have not been), then it is to be attributed to the fact that there are those who do not wish the experiment to succeed, and that it is purposely made to fail. No other conclusion is possible for any reasonable person.

It seems to be generally agreed that there has never before been in this country so great a shortage of freight cars relative to the demand as at present. Steamships which have been chartered to carry cargoes of wheat from the port of New York have been in some instances compelled to load with other freight, because they could not wait for wheat to be transported by rail from Chicago, which city and the country west of it are said to be literally glutted with wheat, the elevators and warehouses not being able to take care of it. As we have previously pointed out, this combination of a very large food crop here, with a short crop and prospect of war abroad, will inevitably have its effect upon business, which, indeed, is already beginning to show decided evidences of returning briskness. A revival of business at this time will be very apt, unless something unusual happens, to continue until after the fair at Chicago, after which something of a lull may possibly be looked for.

The Council of the American Society of Mechanical Engineers has appointed a committee to devise and recommend a series of efficiency tests of engineering appliances at the Chicago Fair. On this committee are Charles E. Emery, who was in charge of the steam boiler tests at the Centennial Exposition, and Prof. R. H. Thurston, of Cornell University, who was a commissioner to the Vienna Exposition of 1873, and a member of the jury of the Paris Exposition of 1889. The third member is Mr. William Kent, M. E., of New York City.

A boulder recently fell on the track of the Maine Central Railroad, and its dimensions were such as to cause the company to lay a track around it until it could be removed by blasting.

Literary Notes.

ELECTRICITY SIMPLIFIED. The Practice and Theory of Electricity, including a Popular Review of the Theory of Electricity, with Analogies and Examples of its Practical Application in Every-day Life. By T. O'Conor Sloane, E. M., Ph. D., Author of "Home Experiments in Science," "The Arithmetic of Electricity," etc.

This is a book in which the author has made it a special object to explain the modern theories of electricity, and draw analogies from them of such character that those who are at all familiar with the science of mechanics, or with physics generally, may, by reading, acquire a comprehensive grasp of the theoretical basis of the science of electricity. The object is to show just why two plates of different metals immersed in acid can send messages around the globe; to explain how a bundle of copper wire, rotated by a steam engine, can be the agent in lighting streets and buildings; to tell what the various electric terms really mean, etc. In this effort the author has been quite successful, and to those who have the study of electricity yet before them the book should prove very helpful. It is 5½"x7", well bound, printed and illustrated, and is published by Norman W. Henley & Co., 150 Nassau street, New York.

HAND-BOOK OF SCREW CUTTING, ETC.—This is a small paper-covered book of 28 pages, prepared by a shop man for the use of shop men, and containing information regarding screws and screw cutting, computing change gears, proportions of threads, gauging and calipering, allowance for shrink fits, computing size of pulleys, etc., with other information pertaining to mensuration, decimals, etc. The language used and directions given are very simple and plain, and the book ought to prove useful to those mechanics who find difficulty in the simpler problems connected with screws and screw cutting.

We cannot approve of the use of the term "Guide Screw," however, instead of "Lead Screw"; not that it is necessarily inferior intrinsically, but "Lead Screw" being the universal term in this country, and there being no possible objection to it, it is worse than useless to confuse matters by introducing a new term.

Some confusion might arise also from the use of the expression, "U.S. Standard V Threads," which we find in this book. There is no U. S. standard V thread, the only standard in this country for machine shop use being that known as the Sellers or Franklin Institute thread. The amounts given in one of the tables, however, as stock to be allowed for depth of thread in drilling for taps, shows that this last-named thread is the one really meant, and not a V thread. The book is published by the author, R. Norwell, Box 263, New Brunswick, N. J. Price, 25 cents.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(560) H. R., Huntington, W. Va., writes: Please give me the address of Geo. W. Melville. *A.*—Direct your letters to Geo. W. Melville, Engineer-in-Chief, U. S. Navy, Washington, D. C.

(561) W. G. S., Chester, Pa., writes: Kindly inform me which issue or issues of the AMERICAN MACHINIST contain the discussion as to whether the steam pressure in a cylinder increases the strain on cylinder head bolts. *A.*—August 6, 20, September 10, October 1, 29, and November 12, 1887.

(562) E. L. B, Grand Rapids, Mich., writes: Please give me rule for finding the length of a belt needed to pass over two pulleys of unequal diameter, the distance from center to center of pulleys and their diameters being given. *A.*—See articles treating on this subject in our issues of July 14 and 21, 1888.

(563) J. A. F., St. Louis, asks: Will a belt running from a 24″ diameter pulley to a 48″ diameter pulley transmit more power than a similar belt running from a 48″ diameter pulley to a 24″ diameter pulley, the belt speed being the same in each case? *A*—No; the transmission will be the same, if speed and other conditions, such as arc of contact, are equal.

(564) D. R. C., Ware, Mass., asks: What is considered best for "marking" to be used in connection with a surface plate for small articles that have to be very closely fitted? *A.*—The best thing we know of is "Prussian blue" that comes in small tubes, and can be bought at the artists' supply stores. Squeeze a little of it out upon a small piece of tin, and add lard or sperm oil to get the desired consistency.

(565) F. R., Newton, Mass., writes: I wish to study drafting; kindly advise me what would be the best plan to follow, and what works to study. I have a common school education, also four years' experience as machinist. *A.*—Study the articles on practical drawing recently completed in the AMERICAN MACHINIST. Also see "What to Study and How to Study," in our issue of February 19, current volume.

(566) F.K., New York, writes: Please publish the names of the officials of the Erie and the N. Y. Central R. R. who hire the engineers and firemen. I am desirous of becoming a fireman, but I do not know to whom to apply. *A.*—Send your application to W. Buchanan, superintendent of motive power, New York Central & Hudson River R. R., New York; and to Ross Kells, superintendent of motive power New York, Lake Erie & Western R. R. These officials will refer your applications to the proper persons.

(567) O. G., Lima, Ohio, writes: Inclosed you will find a sketch of an elliptical gear. The gear was cut out by some one by the means of the cut and try plan, but it fails to stay in gear full depth at the minor axis. I think that shrinkage had something to do with it. Now I am called upon to make a drawing and pattern by that wheel; its major axis is to be 16 inches. I would like to obtain some help to work this out. *A.*—You will find a complete description of laying out gears of this kind in our issue of September 25, 1890.

(568) H. W. T., ——, writes: I am making a steel roller to stamp tin-plate. How would you temper it? I am afraid of warping or cracking. Could I do it in a lead bath? If so, please state how. *A.*—Where such a piece as this is to be hardened, and it is important to prevent springing, it should be done in a muffle furnace, if possible, and if this is not possible then a muffle should be used on the forge. In either case great skill should be exercised not only that the heat at the moment of quenching should be uniform, but that it should be uniform at all times during the process of heating. This is of more importance, we think, than any other thing connected with the operation. We do not think that a lead bath would be suitable for such a job.

(569) H. A., Owosso, Mich., writes: After setting the eccentrics of a locomotive correctly, I find that with the reverse lever hooked up one notch from the center the right-hand side cuts off at the back end at $4\frac{3}{4}$ inches, and the front end at $5\frac{7}{8}$ inches. On the left side, steam is cut off at $4\frac{3}{4}$ inches from the back end and at $5\frac{3}{4}$ inches from the front end. Now I wish to know how and where to make the change so as to cut off at equal parts of the stroke. *A.*—Probably the link saddle pin is not correctly placed; the unequal cut-off may also be caused by an incorrect position of lifting shaft and incorrect length of lifting shaft arms. To which of these causes the trouble is due we cannot say without examining the engine. But since all these pieces of mechanism are fixed, we cannot see how any change for the better can be made without some shop work.

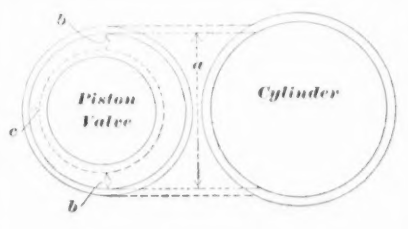
(570) E. W. L., Trenton, N. J., asks: Does the steam pressure in a cylinder of a steam engine increase the strain on the cylinder head bolts before the total force of the steam exceeds the strain on all the bolts due to screwing down the nuts? *A.*—This subject has been thoroughly discussed in our issues of August 6 and 20; September 10; October 1 and 29, 1887. In regard to this subject, Prof. W. C. Unwin, in his elements of machine design, says: "Unfortunately, in practice, the strain likely to be put on a bolt by a workman varies greatly, and cannot be definitely assigned. In the case of cylinder covers, and other similar cases where tight screwing up is to be expected, all that can be done is to assume that the greatest stress due to screwing up will bear some proportion to the water pressure on the cover and then to take a moderate value for the working stress, so as to allow a margin of resistance for rough usage in screwing up."

(571) J. C., Bentonville, Ohio, writes: We are troubled with scales settling over the fire in our boiler. I would like to put my feed pipe in the front end of boiler near the top, and run it towards the back end 10 or 15 feet, then back to front, and down towards the bottom between the flues, discharging the feed towards the back end so as to wash the scales towards that end. Will that heat the water sufficiently so as not to injure the boiler? *A.*—Your boiler is evidently a cylindrical boiler. Although the feed water will be quite hot when discharged, we do not favor the idea of discharging it over the plates which are exposed directly to the heat of the furnace. We should first try kerosene in the proportion of one quart per 100 horse-power daily, blow the water down two gauges every week, and the entire contents every month. If you try kerosene, and the water glass gauges are packed with rubber, you will find that rubber and kerosene do not work well together. In that case use asbestos wicking dipped in boiled oil, and squeeze dry for the packing around the water glass gauges. 2. Please give me some idea of making a balanced valve for a common slide valve engine with 10x20 inch cylinder. *A.*—The balanced valves are illustrated and described in our issue of December 26, 1885. 3. Is there any danger by banking the fire at night? *A.*—No, provided it is done right, so that steam will not be raised during the night.

(572) J. W. S., St. Paul, Minn., writes: Please give me the rule for computing the position of the weight on safety valve lever when the steam pressure, weight of lever, valve and stem are known. Example: Steam pressure, 90 pounds per square inch; distance to fulcrum, 4 inches; area of valve, 5 square inches; weight of lever, 18 pounds; weight of ball, 300 pounds. What will be the distance between the fulcrum and the center of the weight? Please do not give a formula in algebra, as I am not as far advanced as that. *A.*—The rule is as follows: Multiply the area in square inches of the valve by the steam pressure per square inch, and multiply this product by the distance in inches from the fulcrum to the center of valve. Call this product *A*. Multiply the weight of the valve and stem in pounds by the distance in inches from the fulcrum to the center of the valve; call this product *B*; again multiply the weight of the lever by the distance in inches from the fulcrum to the center of gravity of the lever; call this product *C*. Add product *B* and *C*, and subtract the sum from product *A*, and divide the remainder by the weight in pounds; the quotient will be the distance in inches from the fulcrum to the center of weight. It seems to us that you have made a mistake in the statement of the example, because, in applying the above rule, the distance from the fulcrum to the center of weight will be less than six inches, which will not give sufficient room for the ordinary form of ball of that weight.

(573) J. H. B., Findlay, Ohio, writes: I would like you to give me a little information. I am going to try to put a small steam cylinder on a large double engine, for the purpose of running the main engine backwards. What I want to know is to find the size of cylinder. I do not know at present the size of main valves, but if you will give me a rule I will compute it myself after I have obtained the measurements of the valves. The main engines have cylinders 24x30 inches; steam pressure, 80 pounds per square inch, cutting off at $\frac{1}{5}$ of the stroke. The engines run a train of rolls, and sometimes a pipe gets stuck in the rolls, and then we have to pry the engine backwards with crow-bars. It only takes one or two revolutions to loosen the pipe. I cannot put on a link motion, so I propose to attach a small cylinder to the main steam chest, and connect to the valve rod. When the engine is to be turned backward I intend to uncouple the eccentric rods, and then work the small cylinder by hand. Now kindly let me know how much power it will take to move the valves, and how to find the area of the small cylinder. *A.*—We cannot say how much power it will take to move the valve, because we do not know whether it is balanced or not. If not balanced you may approximate the force required to move the valve by taking $\frac{1}{10}$ of the total pressure on the back of the valve. If, for instance, the valve is 10 inches long and 20 inches wide, then its area will be $20 \times 10 = 200$ square inches; and if the steam pressure is 80 pounds per square inch, then the total pressure on the back of the valve will be $200 \times 80 = 16{,}000$ pounds, and $\frac{1}{10}$ of this is equal to 1,600 pounds, which is the force required to move the valve. If now the mean effective pressure in the small cylinder is 70 pounds per square inch, then its area to enable it to exert a force of 1,600 pounds must be equal to $\frac{1{,}600}{70} = 22.8$ square inches, and the corresponding diameter will be $5\frac{7}{8}$ inches. This is, of course, only an approximation, but it will be on the safe side. It seems to us that, if the design of engine will permit, a better way will be to fasten a worm wheel to the end of the crank-shaft, and operate this by a worm which is turned by hand, and which can be thrown out of gear when not in use. An arrangement of this kind is shown on a marine engine in our issue of November 12, current volume.

(574) S. H., ——, Mass., writes: Please give me a practical rule for computing the areas of ports and dimensions of a piston valve for a single cylinder of a steam engine. *A.*—The area of the steam passage at *a* is first found as explained in our issue of May 1, 1890. Assume now that 16 square inches are required for the area at *a*, then our next step will be to determine the length and width of passageway in this section. These dimensions are arbitrary, and depend much on the judgment of the designer; generally the length at *a* is a little less than the diameter of the cylinder. After the length has been decided upon, we divide the area by the length; the quotient will be the width; hence if we adopt 16 inches for the length at *a*, the width will be one inch. Now the length of *a* also determines the diameter of the casing around the valve, and to save space the piston valve is often placed eccentric with it, as shown. To determine the diameter of the valve, good judgment must be used; there should be an area sufficiently large at *b b* to allow the steam discharged at the left of the valve to pass towards the cylinder, and the steam port area around the valve must never be less than that at the cross section *a*. In computing the port area, account must be taken of the diagonal bars across the ports, which act as retaining guides to the packing rings; these



bars take away about a third of the gross portway. This data enables us to determine the smallest admissible diameter of the valve. To illustrate, in the example we have found that the cross-section at *a* should contain 16 square inches; the port area around the valve cannot be less, and if the port is one inch wide the circumference around the valve must be 16 inches plus the space taken up by the diagonal bars; if the latter take away $\frac{1}{3}$ of the area, then the circumference must be equal to $16 + \frac{16}{3} = 21.33$ inches, and the corresponding diameter will be $\frac{21.33}{3.1416} = 6.7$ inches. But if the steam passage at *b*, *b*, is cramped, the port area on that side is of little account, and the valve must be made larger in diameter. In many of the engines the port area around the valve is from twice to three times that at *a*. 2. Also give me a rule for finding the dimensions of a piston valve for a double engine, one valve to answer for both cylinders, as indicated on the sketch. *A.*—Your sketch seems to indicate a compound engine. For this class of engines a different construction of piston valve will be required, and these, we believe, are patented. We have given an illustration and description of one in our issue of November 12, current volume, page 2.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Ready-made cut Iron list gears. See page 20.

Link-Belting and Sprocket Wheels.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link Belt in use.

Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

$13 00 I Dea L. Drawing Stands. The original. Send for postal. W. S. Rogers, Troy, N Y.

S. A. Smith, 23 South Canal Street, Chicago, Ill., agent for Holbrook's Raw Hide Blanks for Gears.

Our Automatic Gear Cutting Machine will increase production 50%. The Superior Mach. Wks., Clev'd, O.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Planer Chucks and 13″ Upright Drills. For cuts and price address G. W. Jordan, No. 4 Wayne Street, Worcester, Mass.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co, 138 Jackson St., Chicago, Ill.

Save small iron from foundry refuse. It pays. Use the Woodruff Pat. Separating Machine, Audubon Machine Works, New Haven, Conn.

For Sale—One second hand Whitworth Traveling Head Shaper, 12x36 inch; all in first-class order; cheap. W. P. Davis, Rochester, N. Y.

N. Y. City Bolt & Nut Co., Limited, 33 and 35 Desbrosses St., N. Y. City, manufacturers of Machine Bolts of every description. Write for estimates.

"Roper's Hand-books for Eng'rs and Firemen." Descriptive Catalogue mailed free to any address. Edw. Meeks, Pub., 1012 Walnut St., Phila., Pa.

"Hawkins' Calculations for Engineers," 10 Parts, 25c. each, bound, $2 50; Catalogue free; Theo. Audel & Co., Pubs., 91 Liberty St., N. Y.

25″ / 32″ / 37″ / 42″ — "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

Complete treatise on Screws and Screw-making, with clear and concise explanation of the methods; 95 illustrations. Price, $1.25 postpaid. E. & F. N. Spon, 12 Cortlandt Street, New York.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Club Rates.—If no one is getting up a club for the AMERICAN MACHINIST in your town or establishment, send for Circular of New Club Rates, and try it yourself. Address AMERICAN MACHINIST, 96 Fulton St., New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

MANUFACTURES.

The erection of a town hall is being agitated at Steelton, Pa.

John C. Kelly, of Nicetown, Pa., will erect an iron foundry. Plans are now being prepared.

It is possible that a rolling-mill will be erected at Pinson, Tenn.

A mineral wool factory is to be established at Roanoke, Va.

The Warren (R. I.) Foundry Company is to erect a new building.

The Gloucester Pipe Works, at Gloucester, N. J. are to be enlarged.

Work has commenced on the new Harris Iron-mill, at Irondale, Pa.

The Pittsburgh (Pa.) Locomotive Works will build a large machine shop.

The Queen City (Texas) Iron Works will rebuild its shop recently burned.

The car repair shop at the steel works at Steelton, Pa., is to be enlarged.

A new iron boiler shop is being erected at the Cramp plant at Philadelphia, Pa.

The new gun factory at Wilkesbarre, Pa., will start up early in the coming year.

McDonald & Sons, Wytheville, Va., have started their iron foundry and machine shop.

It is rumored that several new industrial plants are to be established at Madison, Me.

C. E. Baker, of Rock Run, Ala., is reported as to establish a machine shop at Acworth, Ga.

Mr. Ryby, Christiansburg, Va., is reported as to put in an incandescent electric light plant.

J. W. Jordan, now of Iskooda, is reported as to establish a blacksmith shop at Bessemer, Ala.

At Birmingham, Ala., the Vanderbilt Steel and Iron Company will increase the capacity of its plant.

J. & W. Jolly, manufacturers of turbines, Holyoke, Mass., will add a new shop to their plant.

Some repairs and additions are to be made to the Edgar Thompson Steel Works, at Pittsburgh, Pa.

The Keystone Bridge Company, of Pittsburgh, Pa., is rebuilding part of its erecting department.

The Howe Stove Works, at Tallapoosa, Ga., are about completed, and will soon go into operation.

The Omaha and Grant Smelting and Refining Company will establish a copper plant at Omaha, Neb.

The Houston City Street Railroad Company will build a large car house and car shops at Houston, Tex.

It is announced that the Buffalo Cast Iron Pipe Company will erect a large foundry at Buffalo, N. Y.

Some more new machinery is to be placed in the Columbia Tin-plate Company's plant at Piqua, Ohio.

A hardware factory now operating at Trenton, N. J., is reported as to be removed to Martinsburg, W. Va.

Messrs. Allen, Collat & Fuller contemplate the establishment of an electric light plant at Calvert, Texas.

The Radford (Va.) Pipe and Foundry Company is reported as to put an electric light plant in its new works.

Two new boilers of large capacity are to be placed in the plant of the Anderson (Ind.) Paper Company.

The machine shops owned by R. R. Mingus, recently destroyed by fire, at Glasgow, Ky., will soon be rebuilt

The Tacoma shops of the Northern Pacific, located at Edison, Wash., will be started up about January 1.

Robert Smith has purchased the Hancock Iron Foundry, at Winchester, Va., and will probably operate it.

The new addition to the plant of the E. W. Bliss Company (Limited) at Brooklyn, N. Y., is nearly completed.

A foundry and machine shop will be established at Ivanhoe, Va., by J. H. Gillis, formerly of Raleigh, N. C.

It is stated that the Charleston, Sumter & Northern Railroad Company will erect machine shops in Sumter, S. C.

An increase of $100,000 is understood to have been made in the capital of the Troy Malleable Iron Company, of Troy.

The Imperial Phosphate Company, capital $50,000, has been incorporated at Istachatta, Fla. B. R. Milam is secretary.

Augustus Wolfe & Company will further enlarge their milling machine plant, at Chambersburg, Pa., early in the spring.

The Emory River Ice Company, recently organized at Harriman, Tenn., will erect its plant, at a cost of about $17,000.

The stockholders of the Napier Iron Furnace Company, Nashville, Tenn., have voted to increase the capital to $300,000.

A new steel bridge is to be erected by the Peoria, Decatur & Evansville Railroad across the Wabash river, at Grayville, Ill.

The Pascagoula Ice Company is erecting a building at Scranton, Miss., and will put in machinery for manufacturing ice.

The Plymouth Bridge Company, of Wilkesbarre, Pa., has been organized by Stanley W. Davenport, of Plymouth, and others.

The new shop of the Foster Machine Company, at Westfield, Mass., has been started up on cone and tube winding machinery.

The contract for building a bridge across Cahokio Creek at Warden, Ill., has been awarded to the Missouri Valley Bridge Co.

Two additions, 100x30 and 100x40, respectively, will be built to the works of the Jenkins Machine Company, at Sheboygan, Wis.

E. W. Barton is building a machine shop and foundry in South Lawrence, Mass. He will manufacture paper mill machinery.

An Eastern syndicate is negotiating for the purchase of the bolt works of the South Tredegar Iron Company, Chattanooga, Tenn.

An Eastern syndicate is negotiating for the purchase of the bolt works of the South Tredegar Iron Company, at Chattanooga, Tenn.

The Russell Manufacturing Company is building an addition to its mills, at Middletown, Conn., for the manufacture of elastic fabrics.

The Flanders Woolen-mills Company, North Dexter, Me., will increase their output by adding two more sets of machinery to the plant.

The Frankel Manufacturing Company, Baltimore, Md., making seamless hosiery and cardigan jackets, is to add new machinery, it is reported.

The Norfolk & Western Railroad Company (office, Roanoke,) will construct two additional piers at Lambert's Point (P. O. Norfolk), Va.

The White Sewing Machine Company's new factory at Cleveland is to be 82x200 feet, of brick, three stories high, and will cost about $17,000.

The May Mantel Company, Atlanta, Ga., manufacturers of mantels and architectural iron work, will increase its capital from $18,400 to $25,000.

The Bristol (Tenn.) Iron Works has been organized, with a capital stock of $5,000, to manufacture automatic monkey wrenches and the Fields plow, etc.

Investigations are being made by a German capitalist for the establishment of a $100,000 factory in Galveston, Texas, to manufacture Nottingham lace.

The city council of Huntsville, Ala., has passed an ordinance authorizing the issuance of $20,000 of bonds for the improvement of the water-works system.

A company is being organized at Monroe, Louisiana, for the building of an iron foundry and car shops at that point. J. J. Harper and others are interested.

The Kittseiman Wire Fence Company, of St. Thomas, Ont., is being organized, with a capital stock of $10,000, for the manufacture of wire fence goods, etc.

The Belden Machine Company, of New Haven, Conn., will build an addition to its works, the dimensions of which will be 250x75 feet, and two stories high.

The Southern Malleable Iron Works, Chattanooga, Tenn., has, it is stated, put in operation a 20-ton furnace, thus doubling the capacity of its iron works.

Pawling & Harnischfeger, Milwaukee, Wis., send us a catalogue in which is illustrated and described special machine tools for boring, turning, etc., made by them.

E. L. Wilson, L. J. Ropke, J. W. Campbell and others have incorporated the E. Wilson Hardware Company, at Beaumont, Texas, with a capital stock of $10,000.

The Ice Delivery Company, capital $50,000, has been incorporated at Covington, Ky., by Walter H. Field and others, to manufacture ice and establish a cold storage plant.

It is said that the Pittsburgh & Western Railroad will build an iron tunnel in Allegheny at the end of the Sixteenth street bridge, to replace the present stone tunnel.

The P. A. Frasse & Company, of New York, has been incorporated, to manufacture hardware. Capital, $50,000. The directors are: J. L. Howe, A. E. Brion, and C. F. Frasse.

The county commissioners of Corpus Christi, Tex., have decided to construct an iron bridge over the Santa Gertrude, and one over the Peronia River, at a cost of $6,700

The hardware department of the Chicago Drop Forge Works, whose works are situated at Kensington, Ill., one of Chicago's suburbs, is to be removed to Milwaukee, Wis.

The H. W. Hill Company, of Decatur, Ill., has been organized, to manufacture hardware specialties; capital stock, $25,000. Incorporators, H. W. Hill, W. Cantwell and others.

The Fox Machine Company, Grand Rapids, Mich., has issued a circular illustrating and describing the machines made at the works. The catalogue will not fail to interest mechanics.

Plans have been prepared for a factory addition for the Bridgeport Machine Tool Company, Bridgeport, Conn. The building will be 73x82 feet, 2 stories, built of brick, and will cost $10,000.

The Nowlin Safety Switch & Signal Company, of Chicago, has been chartered, to manufacture railroad appliances. G. E Nowlin, Charles Kirchner and W. G. Barne are the directors.

John F. Lang, J. W. Roper, E. J. Rector and others have incorporated the Lang Motor Company, for the purpose of manufacturing the Lang motor, etc., at Chattanooga, Tenn.

The Summerton (S. C.) Fertilizer and Manufacturing Company has increased its capital stock, and will expend several thousand dollars in the improvement of its fertilizer factory.

A new concern has been incorporated at Chicago, Ill., to be known as the Western Boot and Shoe Machinery Company. It will manufacture boot and shoe machinery. Capital, $50,000.

J. F. Adams, R. Randall and others have incorporated the Adams Track Clamp Company at Birmingham, Ala., for the manufacture of track clamps. The capital stock is $150,000.

Edes, Mixter & Heald, of Clinton, are investigating, with a view of removing their zinc works to Knoxville, Tenn.; they are also reported as to erect ten additional furnaces, at a cost of $250,000.

The Ajax Forge Company, of Chicago, is building an addition, so as to increase the output of its switch crossing department by one-half. It will be of brick, and the dimensions are 100x125 feet.

The talk about the cotton factory at Hammond, Ind., has again revived by the reported purchase of 140 acres of land by an Iowa syndicate, which is said to have in mind the establishment of a cotton-mill.

The city council (Mobile, Ala.,) will advertise for bids for the erection of an electric light plant of 200 arc lights capacity; also for bids for lighting the city with 180 lamps. For particulars address the mayor.

The Dry Dock Engine Works, at Detroit, Mich., have contracted for a new plant to cost about $100,000. The dimensions will be 201x66 feet, and the entire structure will be as nearly fire proof as possible.

A company, to be known as the New Haven Axle and Nut Company, has been secured for New Haven, Conn., and will manufacture a patent spiral groove, a patent nut and other lines of carriage hardware.

An Ohio party is in correspondence with the Bessemer Land and Improvement Company relative to the establishment of a factory in Bessemer, Ala., for the manufacture of locks, latches, door knobs and fittings, etc.

The George's Creek & Cumberland Railroad Company is reported as erecting car shops, 120x40 feet, for the manufacture of gondolas, at Cumberland, Md., and as to build an iron bridge over George's Creek.

The Martinsburg Mining, Manufacturing and Improvement Company has made arrangements with the Phœnix Lock Company, of Newark, N. J., for the removal to Martinsburg, W. Va., of a builders hardware factory.

The Enterprise Elevator and Safety Company, of Cincinnati, O., is reported as having purchased the elevator works of the Chattanooga Elevator Company, Chattanooga, Tenn., and as to enlarge and operate the same.

The Taylor Decarbonized Iron and Manufacturing Company has been incorporated in Montreal, Canada, with a capital stock of $150,000, for the purpose of manufacturing decarbonized iron by the Taylor process.

The Marden Frog & Crossing Works, of Chicago, are adding to their plant a brick addition 72x140 feet. Additional heavy planers, drills, rail bender and new furnaces will be put in, and the capacity increased by one-third.

A shipment of 12 car-loads of machinery for the Swift Powder and Cartridge Company arrived at Tallapoosa, Ga., recently, and work on the factory and mills will be pushed as fast as possible; 1,000 hands will be employed.

J. H. Reid, of Cambridge, Ohio, has, it is stated, completed arrangements with the Bessemer Land and Improvement Co. for the establishment of a builders' hardware factory, with a capital stock of $100,000, in Bessemer, Ala.

The Muskegon Iron & Steel Company has completed its buildings and furnaces at Muskegon, Mich., for making steel by the Adams process. There are two furnaces, with a combined capacity of 1,000 tons of steel a week.

The Alabama Bridge Company has been organized at Anniston, Ala., for the purpose of designing and constructing railroad bridges, with T. R. Houser as president; C. J. Houser vice-president, and W. E. Robertson engineer.

The Michigan Car Company, of Detroit, has just obtained a contract to build 500 freight cars for the Pennsylvania system. In order to get the work done by the time specified it will be necessary for the shops to run day and night.

The assignees of the Blandon Iron and Steel Company, of Blandon, Pa., are endeavoring to organize a new company, with the creditors as stockholders. It is quite probable that a settlement will be effected, and the works started up again.

The Lake Erie Brass and Bronze Foundry, of Cleveland, started last July by A. Wathey and T. McDonald, has been extended twice since that time, and now further additions are contemplated, including machinery for finishing brass work.

The Somersworth Machine Company, of Great Falls, N. H., is being reorganized on a new basis. The bonds will be turned in at par, and the stock at $10 per share. The holders of these will be given for their holdings new stock with a par value of $100.

The contract for the iron roof trusses of the manufactures building of the exposition has been awarded to the Edge Moor Bridge Works, of Wilmington, Del., at the rate of 4 1-10 cents per pound. The total amount of the contract is approximately $460,000.

The Illinois Steel Company have decided to dismantle their nail factory at Bay View, near Milwaukee, Wis. The machinery has been sold to the Hammond Nail Company, of Hammond, Ind., and the work of shipping it to that place has been commenced.

The new sheet-mill now in course of erection by the Canonsburg Iron and Steel Company, of Pittsburgh, Pa., whose plant is located at Canonsburg, Pa., will be completed some time in January. It will give employment to a large number of additional men.

It is probable that, at no distant day, Denver, Col., will boast of a large barb wire and nail works. It is said that a company, having at their command a capital of $250,000, have perfected plans for a plant at that place, and that operations will begin at an early date.

Allen & Forbes, two Buffalo machinists, have recently gone into business at 134 Washington street, Buffalo, N. Y. They will do a general machine business and also pay special attention to model making. Brewers' repairs are also a specialty with the firm.

The Johnson Company, of Johnstown, Pa., has purchased 25 acres of land lying between the Somerset and Cambria Railroad and Stony Creek. It is locally reported that the company will build a new steel works, and even contemplates the erection of a blast furnace.

The Eureka Tempered Copper Company, North East, Pa., has issued a small catalogue, mainly made up of testimonials from those who have used the material they make. The catalogue will interest every mechanic, and especially those interested in electric lighting.

The Buel Manufacturing Company, of Akron, O., with a capital stock of $25,000, whose purpose is to manufacture agricultural implements, have filed a certificate of incorporation with the Secretary of State; incorporators are E. M. Buel, J. A. Buel, C. T. Buel, P. C. Buel, B. F. Tracy.

The C. C. Brooks Arms and Tool Company, Portland, Me., has been organized, for the purpose of manufacturing guns, arms, tools and implements. The officers are: President, C. C. Brooks, of Cape Elizabeth; treasurer, Charles M. Jones, of Deering; capital stock, $30,000; paid in, $300.

An effort is being made to establish iron and steel works at Tacoma, Wash. Alexander Delano, of Detroit, Mich., is the prime mover in the enterprise, which includes the building of blast furnaces and rolling-mills. A committee has been appointed to canvass for $200,000 in subscriptions.

The plant established by the owners of the Michigamme mine, near Ishpeming, Mich., for the separation of iron ore by electricity, has proved a success. The works have so far turned out 30,000 tons of high grade Bessemer ore. By improvements being made, low grade ores are refined into the best of steel.

The Chickamauga Foundry and Machine Company, Chattanooga, Tenn., which recently purchased the plant of the Dalton (Ga.) Hay Press Company, is making extensive improvements: a building, 100x160 feet, is now under construction, and when completed the Dalton plant will be removed to Chattanooga.

The Boston & Colorado Mining and Refining Co. has contracted for the erection of two new buildings at its works at Argo, Colo., one for an ore house and the other for furnaces, at cost of $15,000. New machinery will also be added, including a large engine, two sets of crushers, and two sets of cornish rolls.

The Toledo Rolling Stock Company, of Toledo, Ohio, has been formed, for the manufacture of railway rolling stock, and will also purchase, lease and sell the same. The capital stock is placed at $1,000,000. Sheldon C. Reynolds, Charles L. Reynolds, Abram W. Cotton, Fred J. Reynolds and Emery D. Potter, Jr., are the promoters of the project.

The Madison Railway Equipment Company has been organized at Madison, Ill., for the buying, selling and leasing of railroad equipment and rolling stock. The company has capital stock of $100,000. The following are among the principal stockholders: C. D. McClure, Aug. B. Ewing, Paul A. Fusz, L. M. Rumsey, Moses Rumsey, T. C. Salveter, W. Bacon, L. Duestrow and W. F. Nolker.

Greensburg, Pa., is to have a big rolling-mill. An application has been made for a charter by the Greensburg Rolling-mill Company, composed of Gen. A. R. Coulter, George F. Huff, Judge James C. Clarke, Thomas Donahoe, F. J. Clopper and Henry Harris. The establishment of the Greensburg Steel Company, who went to the wall a year ago, has been purchased by the company, and the same will be reconstructed, and a large rolling-mill plant will be located. Three hundred men will be employed.

The Indiana Iron Company and the Toledo Bolt and Nut Company, the two concerns being under the same management, are negotiating for the purchase of the rolling-mill plant of the Lancaster Iron Company, at Lancaster, Ohio. The concern propose to remove their present works at Toledo, Ohio, to Muncie, Ind., and will add a rolling-mill to the same, for the purpose of making iron to supply their bolt and nut department. The new concern will be known as the Indiana Iron Company.

It is announced that the Britton Iron and Steel Company, of Cleveland, Ohio, have in contemplation the erection of a large plate-mill, which will be devoted principally to the making of heavy armor plate. In addition to this it will turn out heavy tank material for the Standard Oil Company, with whom the Britton Company are identified. A site of 70 acres has been secured near Cleveland, where the plant will be located. It will consist of two 25-ton open hearth furnaces, and a 140-inch mill for rolling the armor plate, besides a complete modern equipment for a modern sheet plant.

The Herz Manufacturing Company, composed of Greenville (N.J.) gentlemen, has been incorporated, with a capital of $50,000, over half of which has been paid in. The company will manufacture a transom lock and lifter, patented by Emil Herz. A large building has been leased on Cator avenue, and business will be begun at once. The company was incorporated by the following gentlemen: Reuben Simpson, president; Emil Herz, vice-president; C. A. Hopman, secretary; John Morrell, treasurer, and Adolph Rocholl. Among the subscribers to stock are the following: Messrs. Chas. Gassman, Michael Knoegy, K. Gassman, Fred Siedell, John Knobloch, Geo. Scheetz, Henry H. Holmes, Thos Cogan, James S. Erwin, Lewis Schillier, and J. C. Reinhardt. The opening of this factory is hailed with delight, as it is expected that fifty men will be given employment.

English and American Locomotives.

In our issue of November 12 we referred to some figures given by Mr. M. N. Forney in his discussion with *The Engineer*, of London, regarding the comparative merits of American and English locomotives. At that time, it will be remembered, we said we hoped that Mr. Forney would give some facts relative to the comparative loads hauled by locomotives in the two countries, as this would have an important bearing on the question of superiority. In the current number of *The Railroad and Engineering Journal* these figures are given, and, as might be expected, prove to be very interesting. We cannot find room for the tables and full explanation of them, but give below the general results to be deduced from them—results which, we feel bound to say, are fully borne out by the complete argument as published in the journal referred to.

Taking the case of freight locomotives, it is shown that the average consumption of coal per mile, per ton of cars on twelve representative American roads, was .215 pounds. Data for such an average result for English locomotives seem to be lacking, but taking the case of some new English freight locomotives, run under trial on the North British Railway in 1876–'77, for the purpose of testing the comparative merits of injectors and feed pumps, it is shown by extracts from *The Engineer's* report that the consumption per mile per ton was .272 pounds. This comparison, though, be it remembered, is made between American engines working under ordinary service conditions, and English engines working under trial conditions, which, as every practical man knows, is unfair to the American machines, notwithstanding which they show the best performance.

Comparing English test runs with some test runs made in this country on the New York Central road, with a mogul engine, it is found that the North British engine consumed 59.3 pounds of coal per mile, while the American consumed 127.7 pounds, or more than twice as much. But if we compare the amount of fuel burned per ton per train per mile the proportions are reversed, as the Scotch engine burned .254 pounds, while the American consumed only .105 pounds per ton per mile. As Mr. Forney remarks: "Comment is unnecessary."

Other figures are given, showing that the cost of locomotive repairs per mile run is 5.3 cents on British and 4.25 cents on American roads, not taking into account the further fact that much heavier loads are hauled here, and that, if our roads were equipped with English locomotives doing our work, the extra annual expenditure would be much over $10,000,000.

There is still one point uncovered so far, and that relates to the difference between English and American coal. The former is commonly reported to be better in quality than the latter, and if so, then this would have a bearing upon the matter, and make the showing for American locomotives still better than the figures show.

A Machinist Paradise.

BY C. O. SINE.

The above heading may be suggestive of a well lighted, well-equipped and admirably managed plant for the manufacture of engines or electrical appliances, or something else, but such shops would more probably be the paradise of the one or the few who had designed the plant, then focused their energies in materializing them, rather than the machinists and other workmen who are employed. To them the shop may be homelike, but if they had no hand in designing, or no interest except as employes, their pleasure would be different from that enjoyed by those whose efforts had made the plant a creditable monument to their industry and enterprise. It is not to be inferred from this that machinists may not have equally as creditable and enjoyable a paradise. I believe that every one should have a paradise, as a purgatorial preventive, if for no other reason. The machinist who spends his spare time in the pursuit of some useful object may be said, when he obtains it, or even before, to have a paradise. Contrast a machinist of this kind with one who has no interest in anything but six o'clock and pay day, who works and growls ten hours a day, and eats, sleeps and loafs the other fourteen. All that such machinists lack of being tramps is dull times. The partition between loafing and idleness is thin, and so full of holes that the two are easily merged into one, and the machinist who has no use for spare time soon finds that is the only kind he has, while, on the other hand, the machinist with a paradise is contented and preparing himself for something better, should it ever be offered to him. All summed up, it is a simple case of survival of the fittest.

Of the many machinists I have known, there are two or three who I shall call the reader's attention to as having, or having had, a paradise. The first one to be spoken of was, besides being a good machinist, an inventor. He took no special interest in his work at the shop, but at home among his models and schemes he was happy, and all he lacked of wealth was "one more little trigger," or like insignificant, though important part. This was his reply to my inquiries till I felt that my interest in his progress was not relished, when I ceased to ask him further about how he was getting along in that particular. Later on he confided a new scheme to me which he was just about ready to begin on. As all this happened several years ago, when we were working at the same bench, I shall run no risk in publishing his scheme, for if it is not already patented it is now too late to do so; besides, there is a possibility by publishing it of preventing some one else of re-inventing it. His scheme was as follows: He would have the wall of his well cemented from the top down below the water line, then put on an air-tight cover with two pipes through it. One of the pipes would extend down into the water in the well and up into the house, where it would branch off into such rooms as he wanted supplied with water. Through the other pipe he would pump an air pressure that would be sufficient to force the water into the house through the pipe put in for that purpose. He dwelt at considerable length on the beauty of his system, as well as the economy; for, as he stated, "when once the pressure was pumped in, there was no way for the air to get out only as it would leak out, and that would be so small as to only require an occasional use of the air-pump." After he had clearly stated, and I thoroughly understood his system, he asked me what I thought of it. I replied that if there was no valve in the vein that supplied his well, it was my opinion that, when the air pressure was pumped on top of the surface of the water in the well that it would take the back track, or that it was quite probable that it would find an outlet into some neighbor's well easier than going up the pipe into his house. This failed, however, to convince him that he had mistaken ideas in regard to his system of water works. It aroused his displeasure, however, just what I did not wish to do. I intended only to do a little needed pruning, but got the credit of haggling up his best trees and marring the beauty of his paradise in general.

Since reading the Vicar of Wakefield it seems to me that a great many inventors are closely related to "George Primrose," who, it will be remembered, went to Amsterdam to teach the English language to Dutchmen, but learned after he got there that to make a success of his undertaking it would be necessary for him to be conversant with their language as well as his own. The fact that there are thousands of patents issued that are valueless would go to prove that inventors look at but one side of their inventions. This army of men who invent and re-invent that which is of no practical value may be subject to ridicule, but they are in many respects a clever set of fellows, and have on their list some illustrious names, whose fame, however, does not rest on their patents, but the schooling that inventing brings may have been of great benefit in the accomplishment of that which is of value or importance. At all events, the machinist's spare hour is his most precious time, as it affords him an opportunity to make his own designs and work from them, instead of continually working from those made by some one else, and this is no mean pleasure of itself.

There is another machinist I will speak of only as showing what may be done by applying a few hours a day to the accomplishment of some purpose. He was a man of perhaps 40 years of age—only a passable machinist, but as a "book worm" he was equal to a full regiment of average machinists.

He read history, poetry, fiction—everything that was printed and bound that he could get. Books were his hobby and for a jour., I have no doubt but that his library was the largest ever owned and read by such men. He possessed a remarkably good memory, and could give one information, and lots of it, on almost any subject, but with all that he was a poor man in all respects. He was burdened with knowledge, but lacked the wisdom to put it to any good use.

In "Pittsburgh Shop Notes," in AMERICAN MACHINIST of July 9, 1891, Mr. Miller describes a paradise incomparably more creditable and enjoyable than anything I have ever seen or read of. I refer to what he says of Mr. Brashear. When I read the description of the surfaces produced by Mr. B. I paused to see if there was anything I could think of that would aid my faculties in comprehending that which was so perfect. I thought of a balance our chemist has that will readily weigh so light an amount as the lead that is rubbed off a pencil in making a mark ¼" long. This is done by first weighing a piece of paper, then removing it from the pan, making the mark, and then weighing it again. After making a test of this kind I asked the chemist to balance the beam very carefully, then put his hand in the case at one end of the beam, and see if the warmth of his hand would lengthen that end of the beam and give it the advantage over the other. This experiment proved to be too sensitive for the balance, for no change in it was discovered that could be attributed to such cause.

In according Mr. Brashear a little world of his own, it establishes the fact that a mechanic's province is boundless.

Last summer I took a trip up the lakes—one of the most delightful ways to spend one's vacation that I know of. The scenery along the river above Detroit is fine; also that along the river from Lakes Huron to Superior. Going on a vessel, one gets time to get a good look at an object before he is shot out of sight. The pleasure of breathing pure air is also a strong recommendation in favor of a lake trip, especially if one has to get his supply in the midst of an hundred or more furnaces for eleven months in the year.

I left the vessel at Marquette, Mich., and went out to Negaunee to hunt and fish in that vicinity. I had no intention of visiting any shops, but wandered into one before I knew it. I found the foreman reading the last issue of the AMERICAN MACHINIST, and judging from his remarks it was an important factor in his shop; for he said, "I can't run the shop without it." He spoke of it in the highest terms, and when he learned that I had been reader of it from its infancy, it was a case of old friends meeting. No letter of introduction or masonic sign would have made me more welcome. I spent the balance of the day very pleasantly with the foreman and others in and about the mines, a description of which would alone make a long letter of itself.

Combinations Pay.

That combinations pay those who are on the inside will be pretty generally admitted, and yet the people have but a vague idea of how well combinations do pay. An instance is given in the transcontinental railroad combination, which recently voted to the Pacific Mail Steamship Company the sum of $75,000 per month, conditioned solely on an agreement by the steamship company that it shall not accept freight between San Francisco and New York at such rates as might divert business from the transcontinental roads. The transcontinental railroads dare not do this openly, therefore, as a sort of a blind, which, however, is so gauzy that it deceives no one, the subsidy is paid in the form of a contract for space on vessels. Last year these roads paid over half a million of dollars for space on vessels and did not use the space. In addition to this the combination pays $500,000 a year to the Canadian Pacific for keeping out of the Pacific coast business of the United States, making an aggregate subsidy amounting to $1,500,000 a year to prevent competition in the carrying trade of the Pacific coast. This is but one of many instances that could be cited, showing how combinations pay. It is needless to add that the consumer is called upon to pay the subsidies.—*Stoves and Hardware Reporter.*

Machinists' Supplies and Iron.

NEW YORK, December 26, 1891.

Iron—American Pig—No change of importance has taken place in the condition of the market since our last report.

We quote Standard Northern brands, No. 1 Foundry, at $16 to $17; No. 2 is selling at $15 to $16 50, and Grey Forge at $13.75 to $14 50. Southern brands of good quality are obtainable at $16 to $17.50 for No. 1 Foundry; $15.50 to $16 for No. 2; and $14.25 to $14 50 for No. 3.

Scotch Pig—We quote Coltness at $22, and Eglington at $20 25

Copper—The copper market has been a litt'e firmer during the last few days, and offerings of Lake have been scarcer. The consumers hold aloof, but it is expected they will come in the market before long. Lake Copper is quoted at 10½c. to 10¾c., and Casting Copper at 10c. to 10¼c.

Lead—The market is more or less nominal at 4 25c. to 4 30c. There is no evidence of business. In offerings of January delivery at 4.30c. to 4 32½c. no interest is taken.

Lard Oil.—The market is firmer at 54c. to 55c. for Prime City, according to holder and quantity. Western on spot is quoted at 53c to 54c.

Spelter—The market is nominal at 4.75c. for New York delivery. There seems to be no indication of business here. Reports from the West are more favorable.

Tin—The market is steady and dull, both here and abroad. The only sale in several days consisted of 25 tons for January at 19.90c., and the same price would still buy.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—First-class machinists. Address, The Ticonderoga Machine Company, Ticonderoga, N. Y.

Wanted—A first-class pattern maker. Write to the Jenkins Machine Co., Sheboygan, Wis.

Experienced mechanical draftsman desires position. References. Address K., AM. MACHINIST.

Position wanted as tool dresser, by a first-class tool dresser. Box 20, AMERICAN MACHINIST.

Wanted—Mech. draftsman, quick and accurate, to work under instructions on printing presses; give age, wages expected, and ref. H., AM. MACH.

Wanted, Draftsman—Good mechanical draftsman. One preferred who has had some experience with steam pumping and hydraulic machinery. Address Pump, care AMERICAN MACHINIST.

Young man wants job under instruction on lathe and planer. Worked several years erecting engines (large and small) in shop and at plant. Expect pay for real value of services only. Reliable, AM. MACH.

Young man experienced in design and construction of steam and electric plants, selling machinery and complete plants, and until recently manager of branch office of prominent company, desires engagement. Address Delta, AMERICAN MACHINIST.

Machine shop foreman, with large exp. in managing men, designing of special tools and jigs for improved methods of work, well up in modern practice in tool machinery and hardware, desires to change; A1 references. Straight-Edge, AM. MACH.

Wanted—A No. 1 machinist, with good education, pushing, progressive, used to modern practice and economical management of men, and who will work to his employer's interest, as assistant foreman in shops located near New York; state experience, age, nationality, wages. Address P., AM. MACHINIST.

A first-class designer and mechanical engineer desires a position as chief draftsman with a good firm. Specialty—Corliss engines, boilers, hoisting engines, air compressors, Cornish pumps, refrigerating machinery; age 43 years; first-class references; Chicago preferred. Box 19, AM. MACHINIST.

A young man who has had charge of the mechanical department of a technical school, wishes, for reasons to be given, to change occupation. Would like situation in some manufacturing establishment where he could have a small money interest. Ten years' experience with machinery. Address Box 12, AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Special machinery designed and built. C. F. Langston & Co., 70 N. 4th St., Philadelphia.

Agents wanted in every shop. Money in it. Scientific Machinist, Cleveland, O. Mention A. M.

I wish to contract with parties to make fine composition castings. Address B., AM. MACHINIST.

Wanted—Second-hand Allen Pneumatic Riveter, with or without compressor; state size, price, and when built. Address "Riveter," care AM. MACH.

Special leather and cement for covering pulleys; no rivets required; local agents wanted. Crescent Mfg. Company, Cleveland, Ohio.

To manufacture light special and automatic machinery, novelties, models, patterns, tools, etc., by Orange Machine and Repair Works, Orange, N. J.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

For Sale—A jobbing and contract foundry located in a city of 30,000 population. Skilled labor in abundance, wages not high. Foundry in operation employing 25 men. Full and complete equipment; good will and trade established. Several yearly contracts from best concerns in city will be sold with business; buildings leased for a long length of time. Bright opening for energetic men with moderate capital. Present owners desire to engage in same business on a larger scale elsewhere. Address F. S. C., care of AMERICAN MACHINIST.

Bradley Hammers

REPUTATION.

Men test everything in this world by what it produces.

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SYRACUSE, N. Y.
BRANCHES IN NEW YORK AND BOSTON.

MACHINERY PATTERN MAKING.

Containing Full Size Profiles of Gear Teeth, and Fine Engravings on Full Page Plates, Illustrating Manner of Constructing Numerous and Important Patterns and Core Boxes.

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376 Illustrations. 12mo, Cloth, $2.00.

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BRASS AND BRONZE CASTINGS A SPECIALTY.

By a molder of 50 years experience. Castings guaranteed true to pattern. Get my prices.

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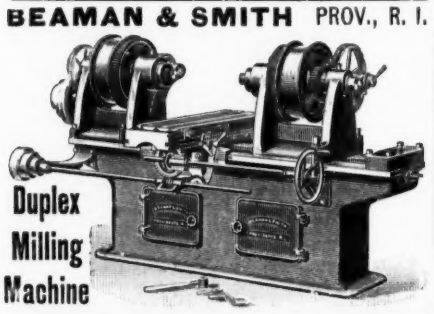

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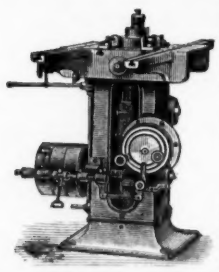

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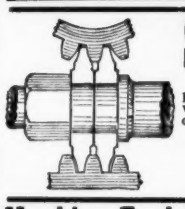

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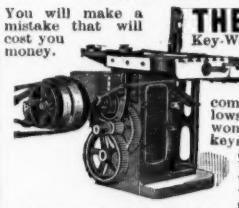

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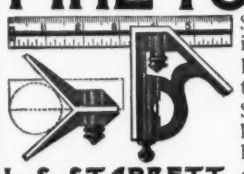

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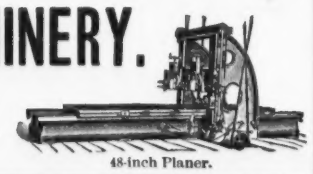

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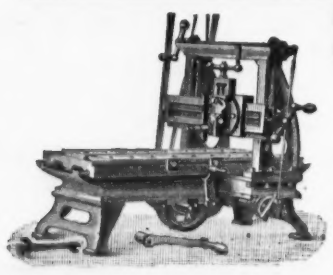

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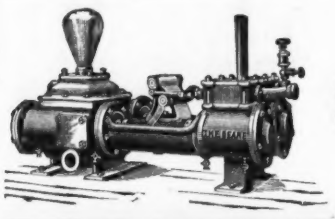

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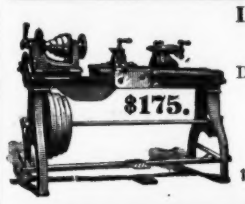

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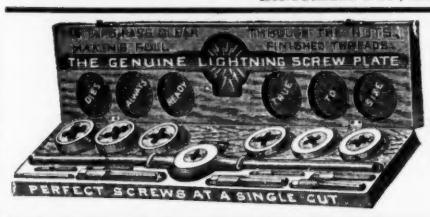

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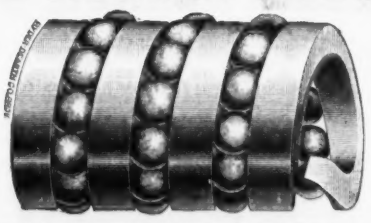

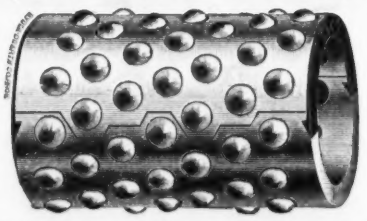

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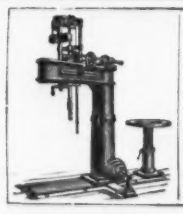

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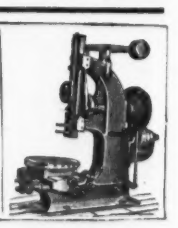

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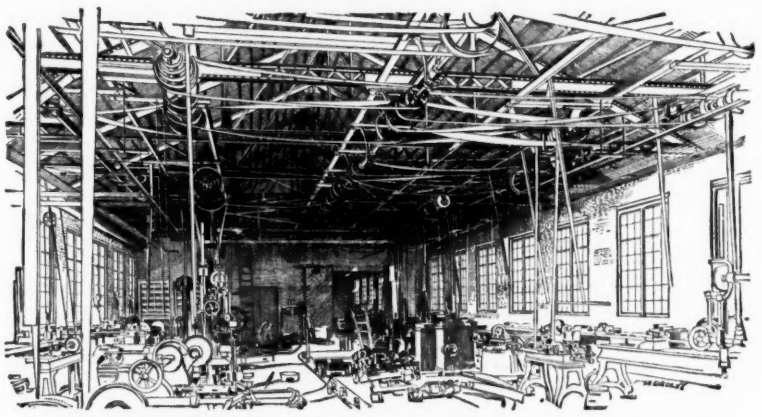

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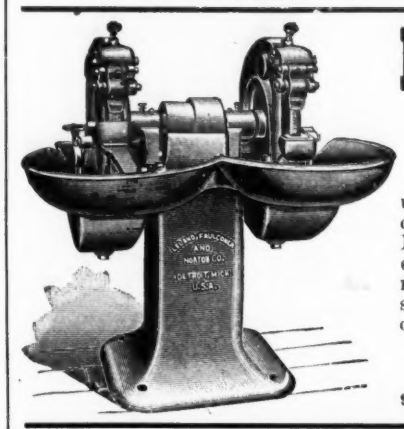

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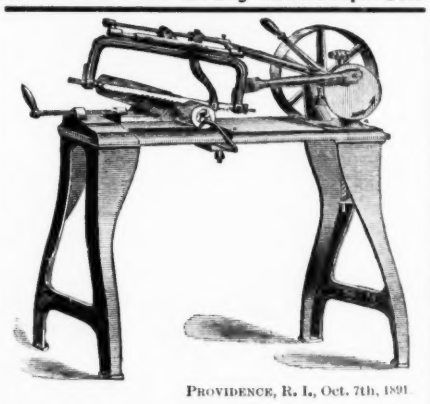

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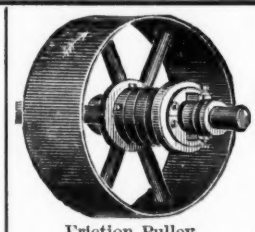

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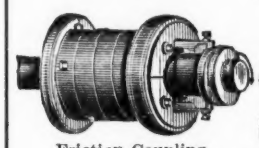

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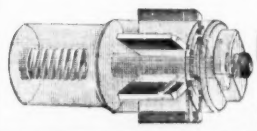

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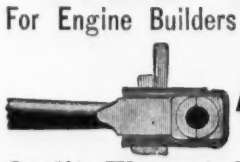

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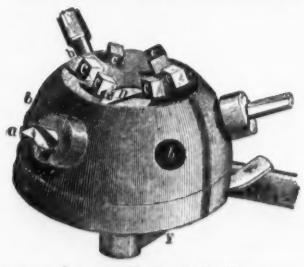

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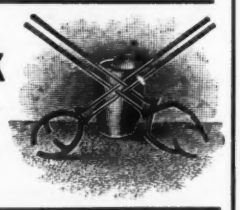

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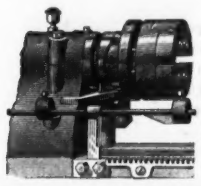

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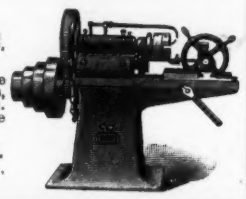

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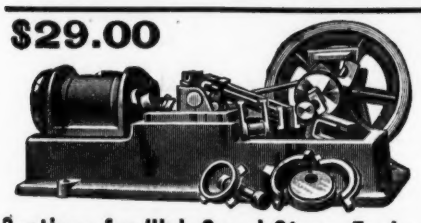

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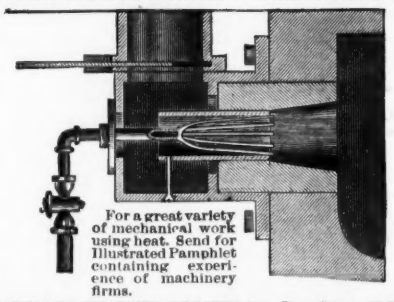

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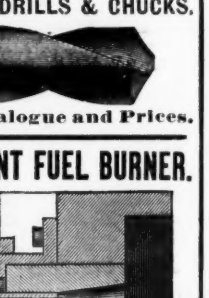

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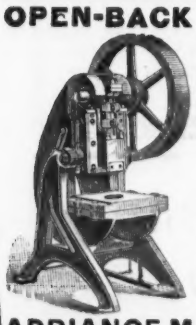

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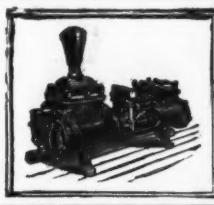

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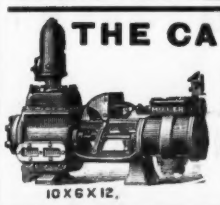
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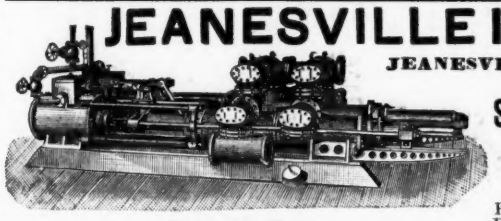
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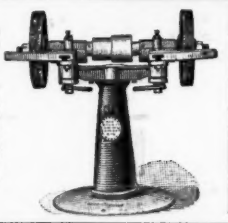

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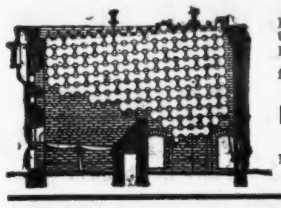

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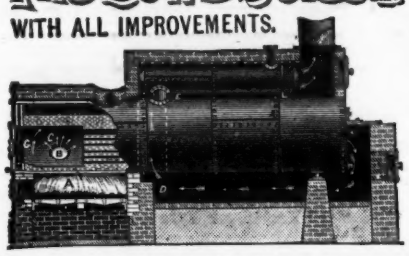

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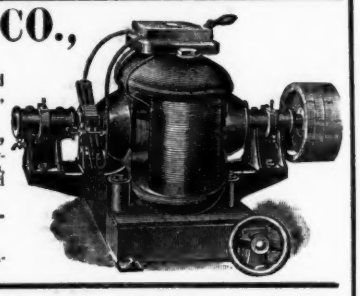

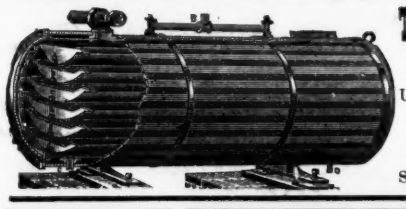

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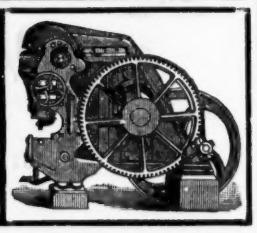

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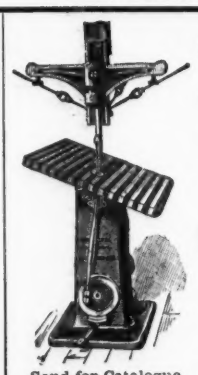

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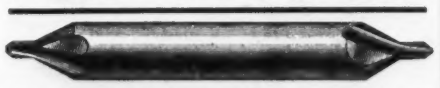

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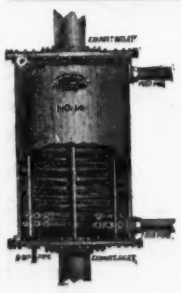

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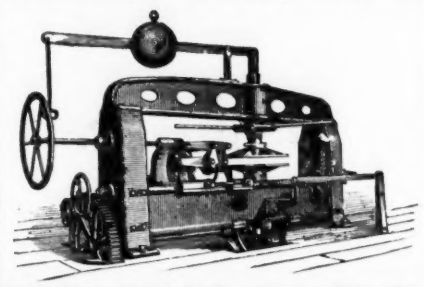

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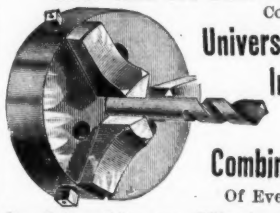

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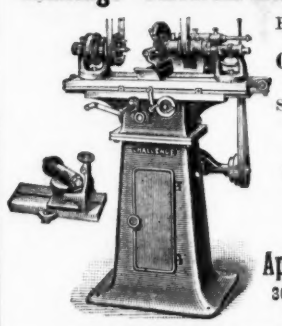

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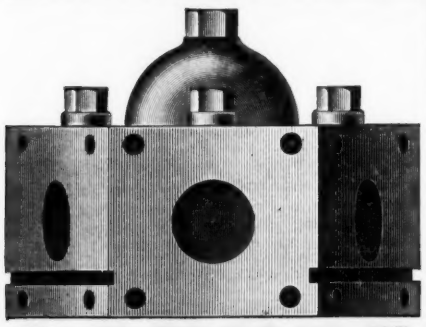

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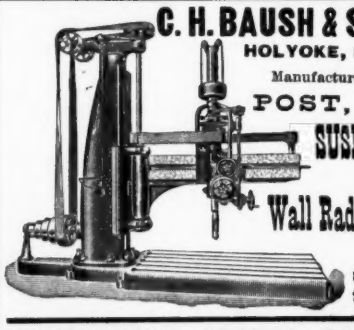

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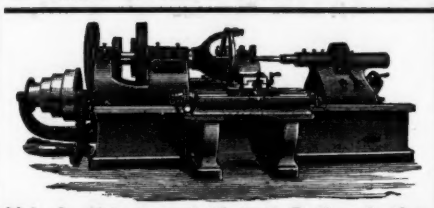

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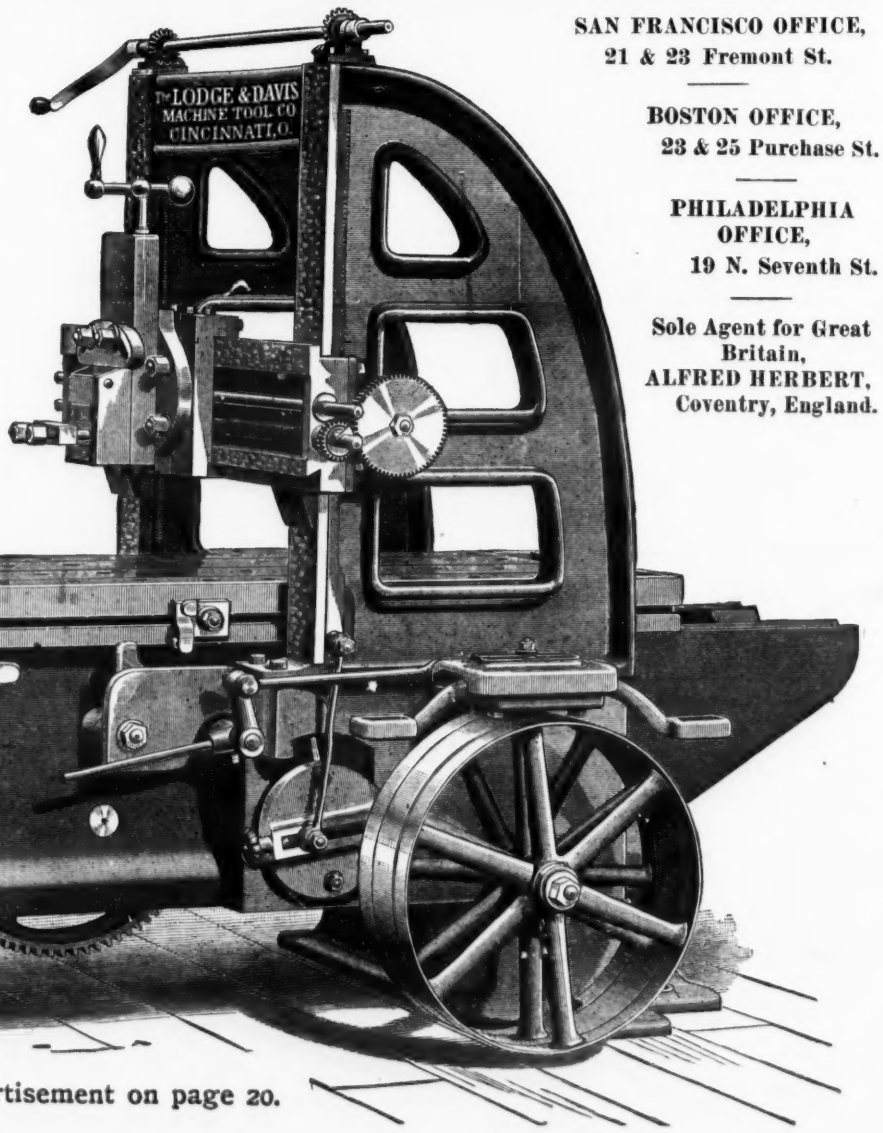

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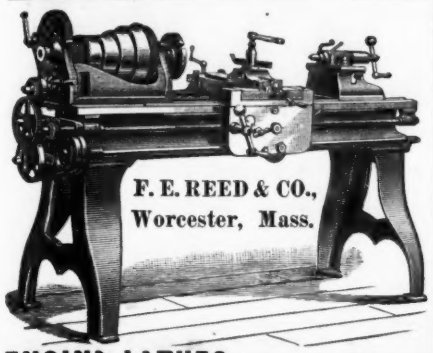

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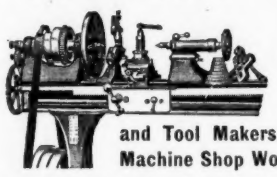

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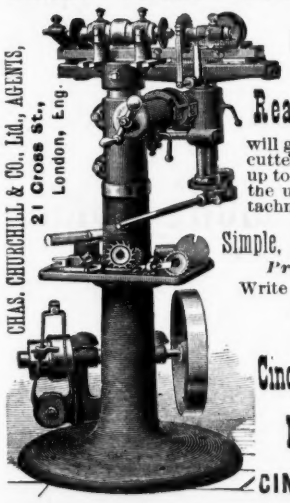

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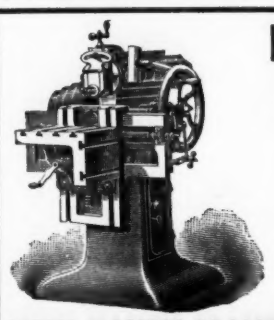

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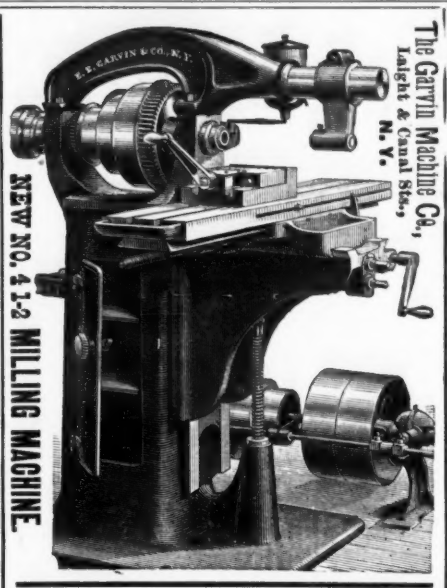

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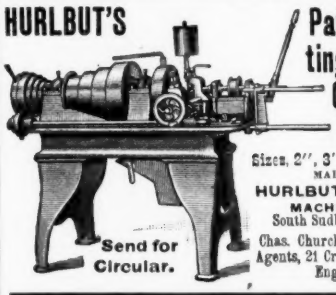

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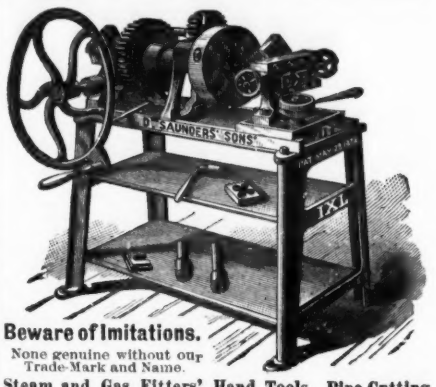

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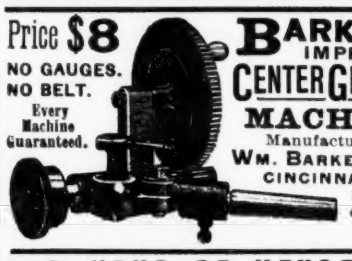

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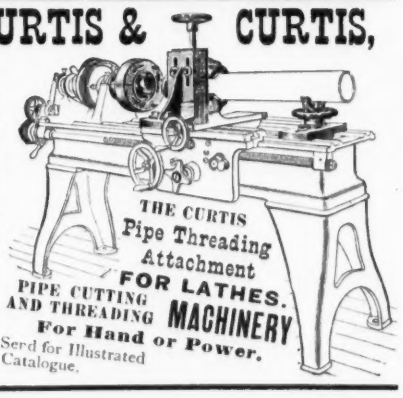

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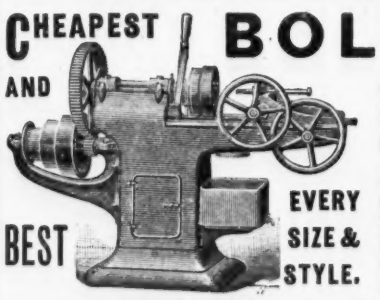

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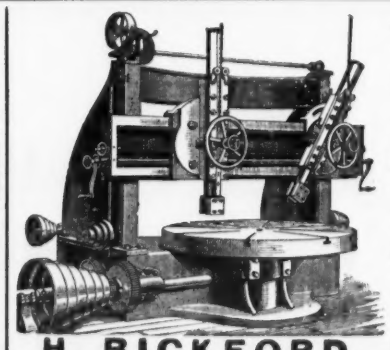

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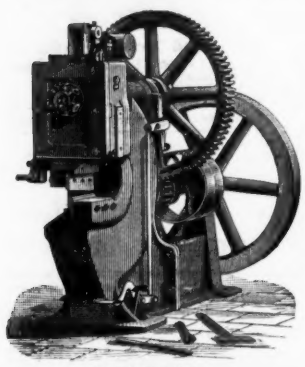
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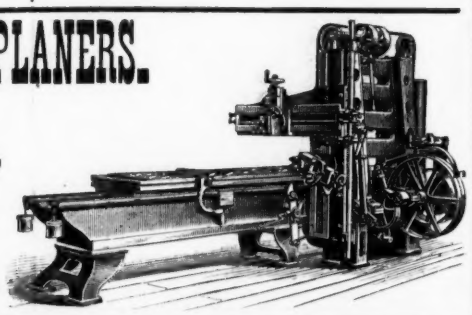

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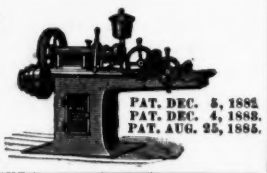
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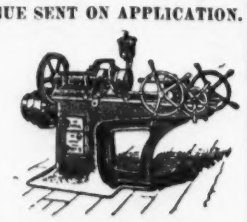

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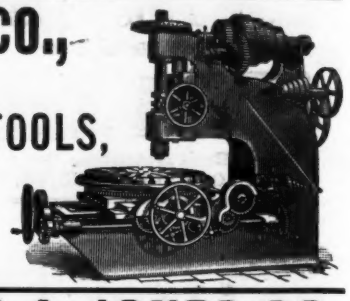

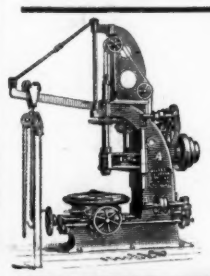
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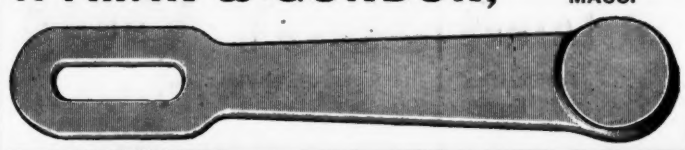

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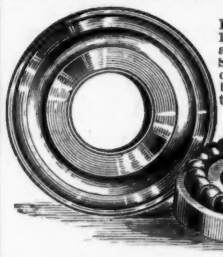
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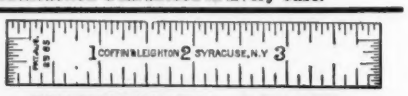

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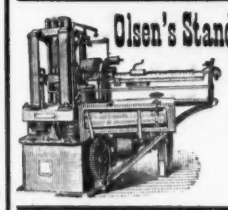
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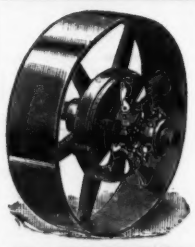
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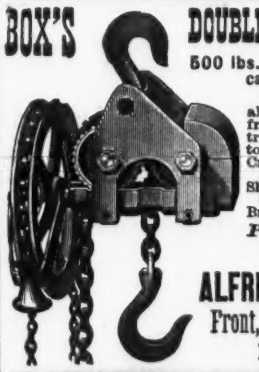
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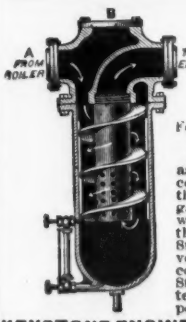

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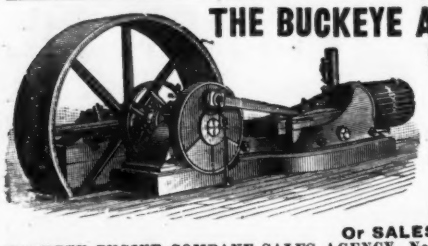

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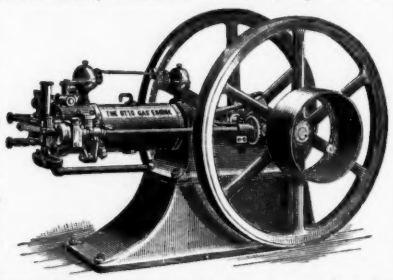

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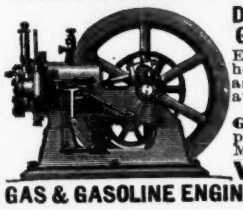

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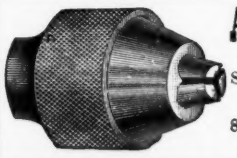

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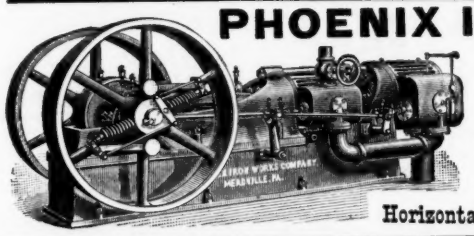

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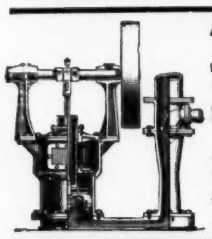

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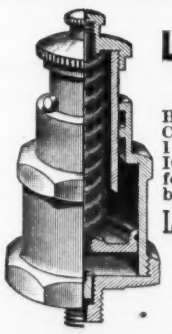

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1 Planer, 24 in. do 6 ft. do	do do
1 Planer, 28 in. do 6 ft. do	do do
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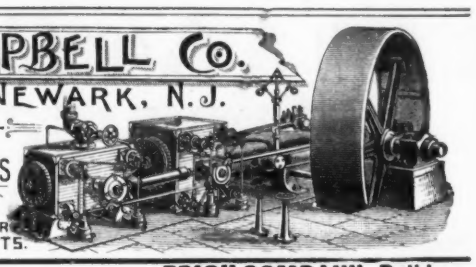

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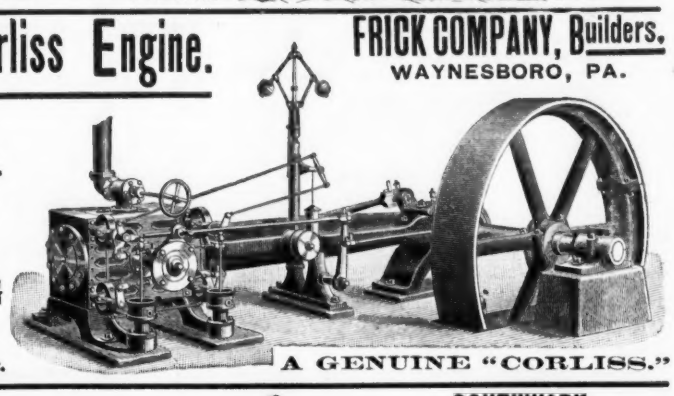

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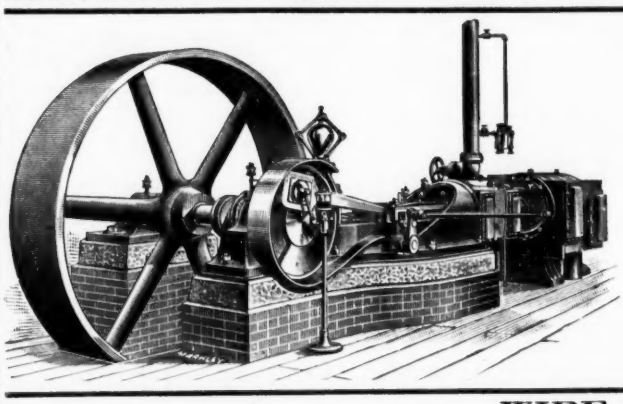

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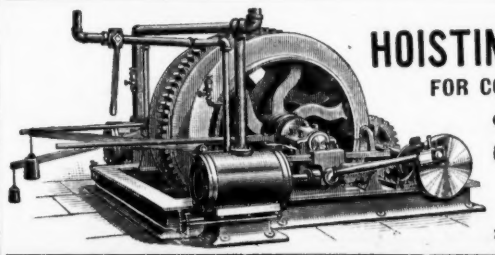

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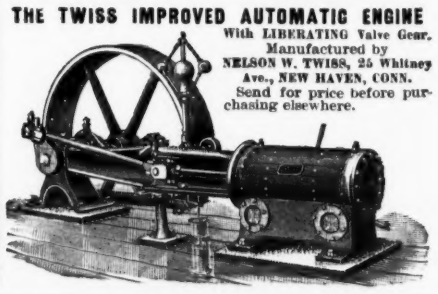

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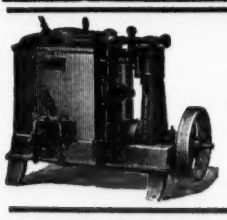

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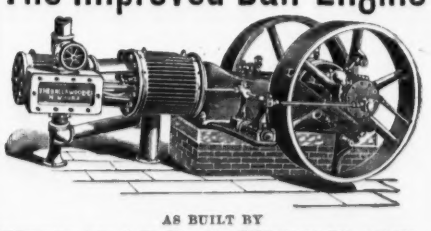

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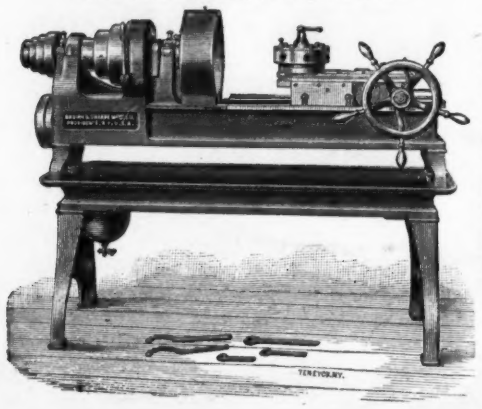

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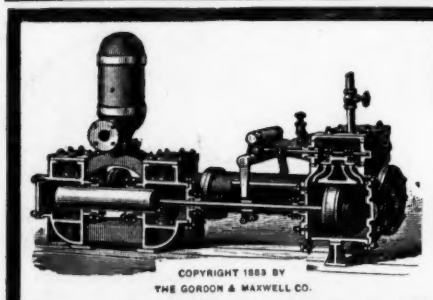

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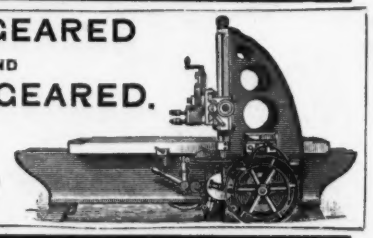
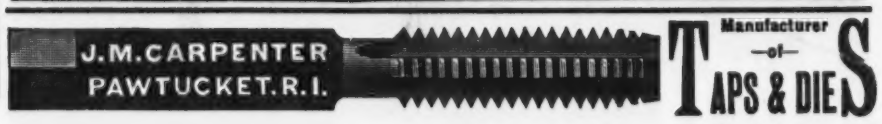
PLANERS

SPUR GEARED AND SPIRAL GEARED.

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